

Railway Maintenance Engineer

Volume 17

CHICAGO—JUNE, 1921—NEW YORK

Number 6



Derails

SWITCH STANDS

TARGET STANDS

Derails, Switch Stands and Target Stands of demonstrated efficiency that are worthy of your interest and at prices that will prove your investigation valuable.

Full Information and Prices on Request.

The Q AND C Co.

CHICAGO 90 WEST ST. ST. LOUIS
NEW YORK

DERAIL

International Steel Crossing Foundations

Why Is the Cost of Crossing Maintenance So High?

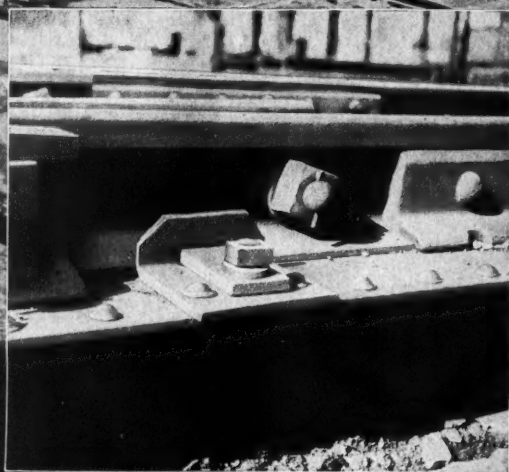
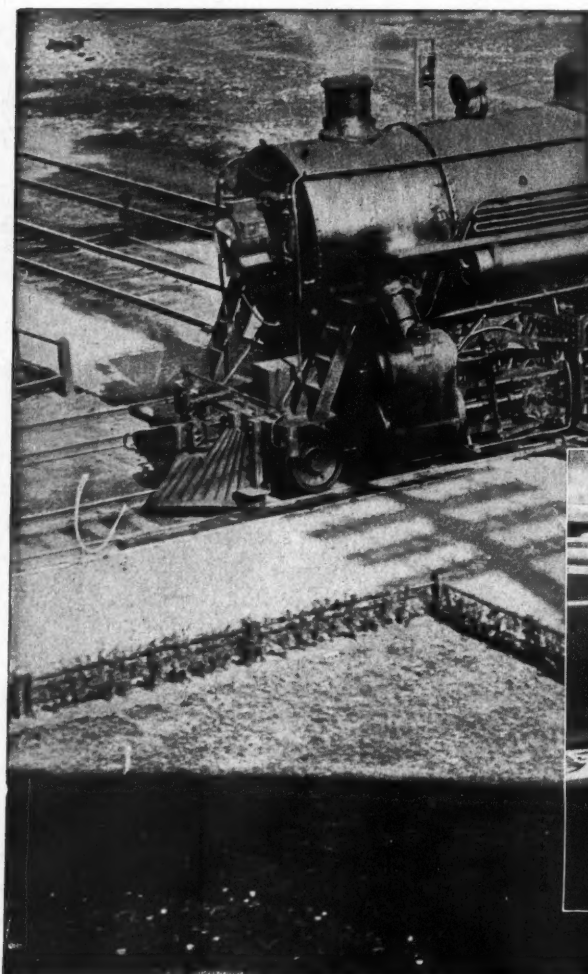
BECAUSE wooden ties cannot be arranged under crossings so as to distribute the loads into the ballast.

If they are located to carry one track, the other must go unsupported.

The rocking, twisting shocks of relentless wheel loads over worn flangeways loosen and break bolts and fillers; movement starts between the members of the crossing and rapid wear and deterioration result.

Users of Steel Crossing Foundations are cutting the high costs by providing a wide based unit bearing of a specially designed steel under-frame cushioned with creosoted wood blocks and provided with efficient rail fasteners.

Your first step towards this economy is to send for proposal plans and estimates on your Spring renewals.



The International Steel Tie Company

Manufacturers of Steel Twin Ties and Crossing Foundations

16704 Waterloo Road, Cleveland, Ohio

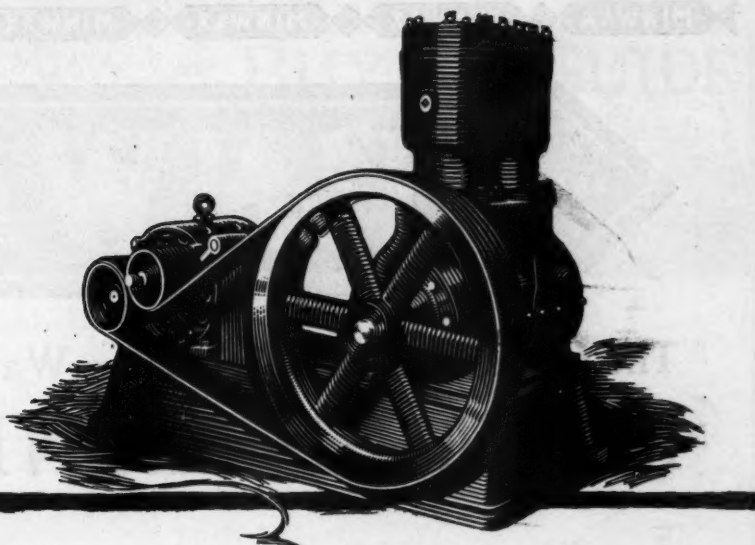
RAILWAY MAINTENANCE ENGINEER

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Gardner-Rix Vertical Air Compressor built in capacities of from 8 to 140 cubic feet of air per minute



GARDNER

Pumps - Governors - Compressors

The Gardner-Rix Vertical Air Compressor is only one member of the Gardner family of good products—built right for 62 years.

It requires small floor space. A compressor capable of producing 70 cubic feet of air per minute occupies floor space 30 by 38 inches.

Fewer parts make it extremely simple, easily understood, and very economical to operate.

Its light weight and compact construction make it popular in mining districts where a portable machine is wanted. Its portability also makes it a favorite for road construction work.

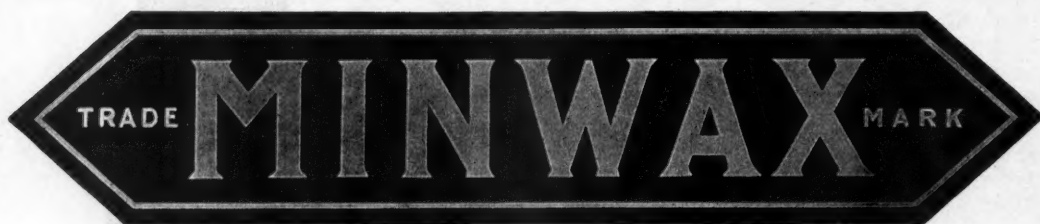


Let this "Mark" govern your purchases of Pumps, Compressors and Governors

THE GARDNER GOVERNOR COMPANY
Quincy, Illinois

Pumps — Governors — Compressors

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The Original Elastic Membrane Waterproofing System MINIMIZES MAINTENANCE

The repeated flexure to which a waterproofing blanket is subject in railway structures emphasizes the necessity for materials having **permanent** elasticity, flexibility and toughness. Only such materials can resist ultimate cracking, meaning a loss of all waterproofing value. The materials used in the Minwax System—Minwax Saturated Cotton Fabric and Minwax Waterproofing Asphalt—have been proved by tests of 15 years of service to form a waterproofing blanket with a life equal to the life of the structures of which they are a part. Minwax Protection is permanent protection.

Write for Bulletin 21

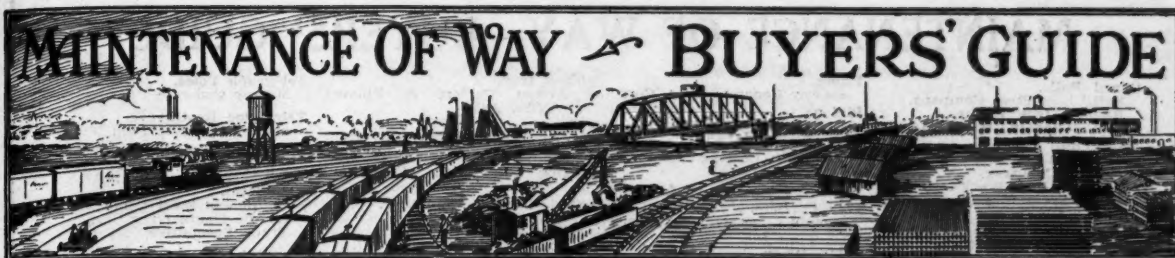
Minwax Company, Inc. *Manufacturers and Consulting Engineers on Waterproofing Problems*
 CHICAGO 327 So. La Salle Street NEW YORK 18 East 41st Street PHILADELPHIA 609 Harrison Building

"The Proof of Quality is a Record of Service"



Mound Ave. Bridge, C. & N. W. R. R., Racine, Wis.; Waterproofed by the Minwax Elastic Membrane System.





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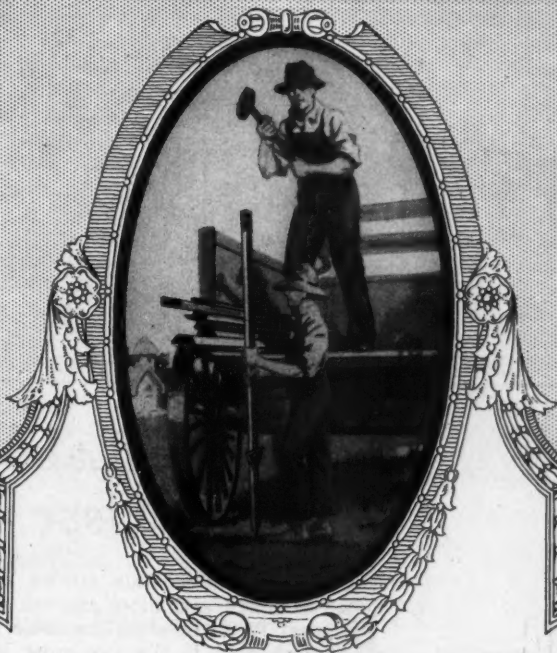
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The RED TOP Guarantee

WE guarantee RED TOP Steel Posts will not break, burn, rot or frost-heave in the fence line; that they are free from defects in material and workmanship; that they will outlast the heaviest fencing manufactured.

We guarantee RED TOP Posts to be just as represented in our literature and advertising.

Any RED TOP Post which does not fulfill the above guarantee will be replaced by your dealer—without cost or argument.

BROOKE ANDERSON, *Pres.*
CHICAGO STEEL POST CO.

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For booklet describing RED TOP Guaranteed Steel Fence Posts and their money saving features, address Maintenance Equipment Co., Railway Exchange Bldg., Chicago, Ill.

Red Top

GUARANTEED

Steel Fence Posts



View of Eastern Laboratory of Repauno Plant, Gibbstown, N. J. One of the five great laboratory groups maintained by the Du Pont Company.

What the Laboratory Brings to the User of Explosives

THE tremendous strides made in the development of newer and more efficient types of explosives during the past fifty years are traceable, very largely, to experimental work done in the five great laboratories maintained by the Du Pont Company.

There, working with minutest care over test tube and retort, or at the ballistic testing apparatus, or in the field making practical tests, are over 300 chemical engineers—men who are devoting their lives to devising safer, more efficient and more economical explosives to be the servants of the great productive and constructive industries of the world.

These facilities for experimental work certainly form an important part of Du Pont Explosives Service. Our vast production, so accurately supervised to insure uniform Du Pont quality; our nation-wide, highly-organized system of distribution, and practical service *at the work* by experts whenever desired compose a very remarkable service—which is yours to command.

Users of explosives have *confidence* in Du Pont Explosives and Du Pont Service—and justly so.

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Sales Department, Explosives Division
Wilmington, Delaware



Carbic

Model M Light



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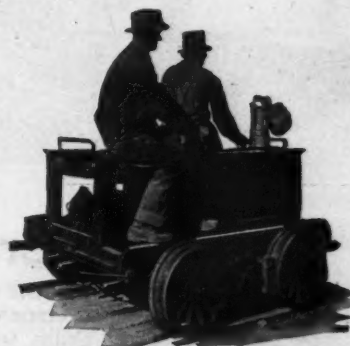
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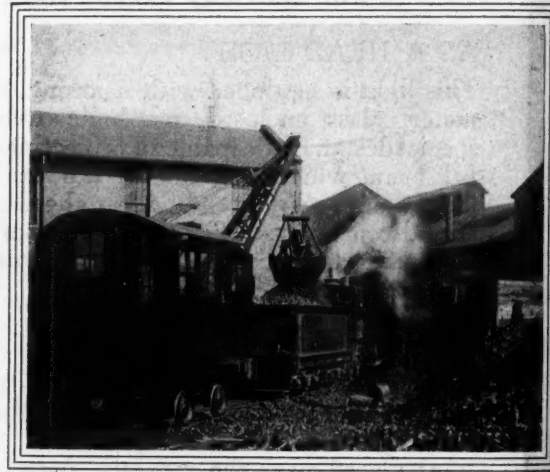
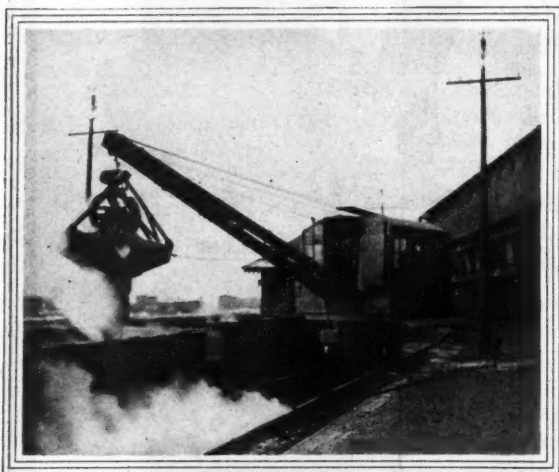
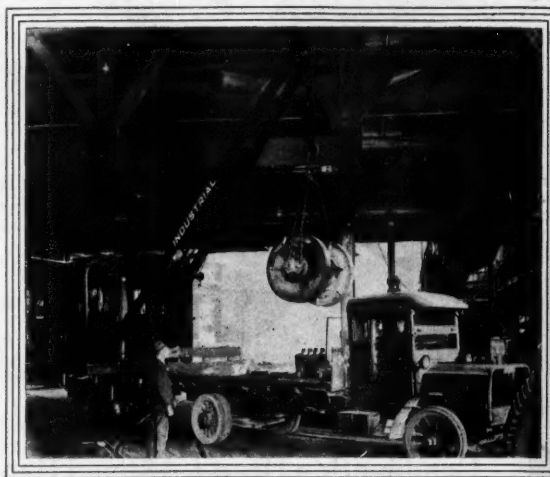
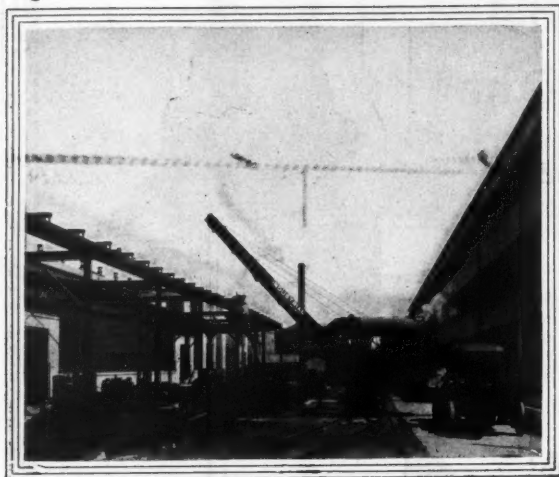
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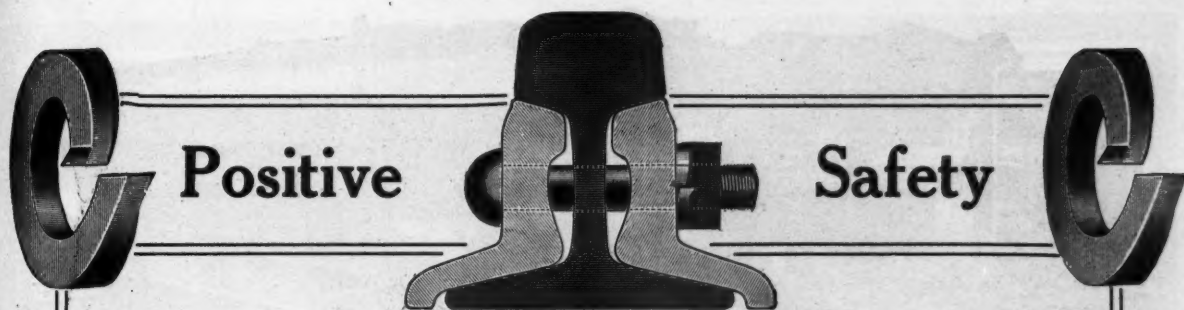


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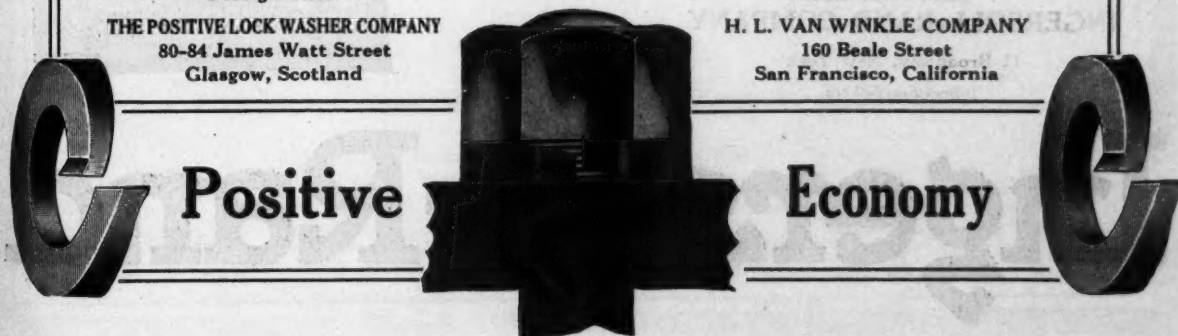
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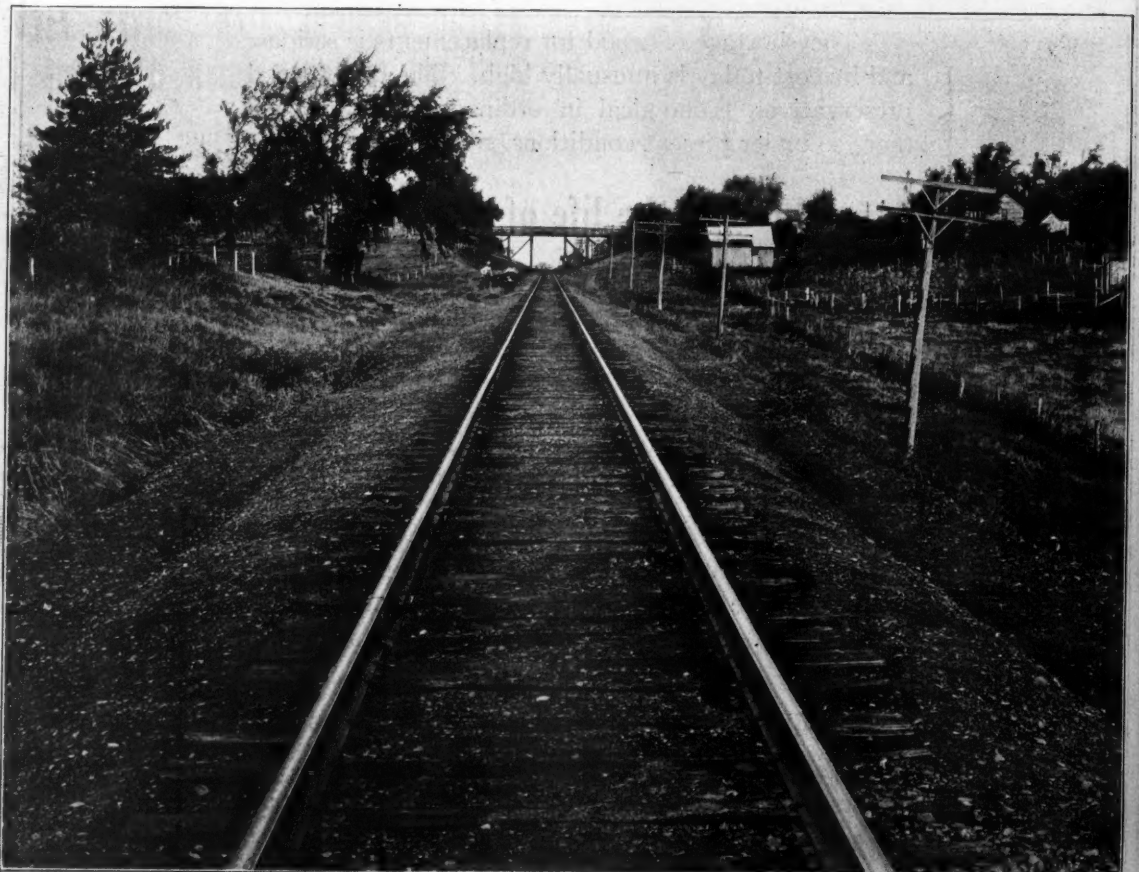
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Vol. 17

June, 1921

Number 6

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Every maintenance man knows that the present period of severe retrenchment in maintenance of way expenditures is resulting in the continued weakening of the tracks and structures. He likewise hopes that this retrenchment is nearing an end and sees evidences that better days are at hand. However, the present fact confronting him is that he is responsible for the safe operation of trains over the under-maintained properties of the railroads. He cannot afford to neglect any precautions to detect and prevent the spreading of rails, buckling of the tracks or other serious mishaps arising from undermaintenance. During the war it was necessary to concentrate the available labor on that work most necessary from the standpoint of safety. This necessity still exists. Every maintenance officer should consider this as his problem and direct the energies of his forces to this end.

The unprecedented demand for materials during the war period resulted in the skyrocketing of prices so that no one could not tell one day what any commodity would cost him on the next. All established relationships in material costs were destroyed and it was only with extreme difficulty that engineers could arrive at a reasonably accurate comparison between the cost of performing a given piece of work according to different methods or with

different materials. The period of adjustment through which we are now passing has brought about a parallel situation. The changes do not take place as rapidly, but there is a pronounced lack of uniformity in the readjustment of prices. Thus, we find that lumber and steel, especially structural steel, have undergone marked reductions. Concrete materials, on the other hand, have suffered but little decline. A closer scrutiny of the market quotations will show that in a given line or class of materials, certain grades, sizes, etc., have undergone greater fluctuations than others. As a result what may have been the most economical structure or the cheapest method of doing a piece of work then may now prove to be the most expensive. In view of this, the only safe policy is to check all estimates for proposed work on the basis of the latest quotations.

About 20 years ago the structural engineers of a number of railroads in this country, located mostly in the mid-

The Concrete Pile Trestle

They risked their reputations on the idea that moving train loads could be carried in safety on concrete slabs reinforced with steel bars. Previously, culvert tops of rails and I-beams had been constructed in which the concrete served solely as a covering for the steel, which was entirely adequate to carry the superimposed load without any assistance from the concrete. But these new reinforced concrete slabs contained so little

steel that it was only through a united action of the steel and the concrete that the loads could be carried safely. A few years later, C. H. Cartlidge, bridge engineer of the Chicago, Burlington & Quincy, applied the reinforced concrete pile to roadway structures in the form of bents to support reinforced concrete slabs. The result was a substitute for the wooden pile trestle in a permanent material. Seventeen years have passed since these first concrete trestles were built, and while only a comparatively small number of the railroads in this country have followed the example of the Burlington, a large mileage of concrete trestles has been built. The lapse of time has been great enough to demonstrate that these trestles are permanent structures in the sense in which this term is understood by the railway engineer. It has also served to bring out a great many facts of value in their design and construction. Minor faults of design and detail were developed early in the construction of these trestles and have long since been satisfactorily corrected, but the creation of a trade knowledge or construction practice has required a much longer time, for it was not to be expected that the best methods of driving concrete piles, of concreting the caps around the tops of them and of placing the slabs, would be developed at once to the same degree of perfection as that which characterizes the long established practices in the building of wooden trestles. Nevertheless, sufficient time has now passed to perfect a great many of the details in the construction of the concrete trestle, and it is for this reason that the presentation on another page of the methods pursued by one railroad in carrying out this work with its regular bridge maintenance forces should be of appreciable value to the officers of other roads who are now building structures of this kind or who are likely to undertake programs in the future which will involve their introduction.

THE LABOR TURN-OVER

BEFORE PRESCRIBING the remedy a physician first makes a careful diagnosis of the trouble. This procedure is so fundamental in medicine that it is taken as a matter of routine. It may also well be extended to problems far removed from medicine—for instance, to those of maintenance of way labor. It is from this standpoint that William S. Wollner has approached the question of labor turn-over in his study of the service records of the men employed for the track and bridge forces on a western railroad, the results of which are summarized on another page.

In this analysis the fact that strikes one most forcibly is the extremely high turn-over of men. His figures show that over 60 per cent of the track men and over 50 per cent of the carpenters hired never reported for

work at all. Equally startling is the further fact that the average length of service of those track men who did report for work was less than 25 days, and of carpenters and carpenters' helpers only three days more, while less than 25 per cent of these men remained in service over one month and less than 10 per cent over two months.

The extreme wastefulness of such a practice is reflected in numerous ways. The cost of recruiting and transporting such a large force of men to the work is not small. The effect of continued changes in personnel on the organization and efficiency of a gang is self-evident. Of even greater importance is the necessity for the continued training of inexperienced men, which not only constitutes a severe tax on the time of the foremen, but also reduces the output of the entire gang.

No problem constitutes a greater drain upon the maintenance of way department than this. While it is of such long standing that many men believe that it is inherent to maintenance work, other industries have devised solutions. The continuance of this condition therefore constitutes a reflection on the ability of maintenance of way officers. Its elimination is necessary now as never before.

A SUPERVISOR'S OFFICE FORCE

MOST supervisors regard their office work as an evil to be shunned as much as possible. The railway managements are in large measure responsible for this attitude on the part of their men because of their grudging allowance for clerical assistance. It is not to be expected that an officer who is required to spend a large part of his evenings in his office making out reports and answering correspondence in long-hand will show a great deal of enthusiasm

for this work. It is also a common statement among them that their place is out on the line where the money is being spent and they are inclined to let the office work take care of itself. There is no question but that this is true in large measure, but they fail to recognize that records are absolutely necessary for the economical conduct of a large organization.

No organization can be suggested which will suit all conditions. As is pointed out in the discussions on this subject published in another column, the amount and character of the office force depends upon the character of the organization in effect on the individual road, the amount of work under way and the manner in which the records are compiled. However, sufficient forces should be provided to enable all routine work to be handled within office hours, to relieve the supervisor of clerical work which a cheaper employee can perform, and to give the supervisor such information as he should have to enable him to determine the efficiency of his op-

THE AMERICAN RAILROAD SYSTEM

The American railroad system is an aggregation of nearly four hundred thousand miles of tracks, a quarter of a million cars, over sixty thousand locomotives and other facilities in proportion, all coordinated to produce transportation. But, even more than that, it represents an investment of nearly twenty billion dollars—the accumulated savings of nearly a million persons. Its control is vested in over 600,000 stockholders, who select the officers to manage these properties. Its bonds are held by many other citizens, banks and by life insurance companies to which we look for the protection of those dependent on us. Even more, it provides a livelihood for nearly two million employees, scattered in every state in the Union, from whose ranks are selected those officers on whom responsibility for the successful operation of the properties has been placed. This is the American railway system—the greatest in the world—the system in whose upbuilding we have a part and for whose reputation we have the highest regard.

erations. This may require only part of the time of a clerk or it may require all of the time of several clerks. The governing consideration should be that of providing sufficient forces for him to do the necessary work well.

THE LABOR BOARD'S DECISION

THE TIDE has turned. After more than four years of increasing wages in the maintenance of way department, the Railroad Labor Board has ordered a reduction, effective July 1. Thus railway employees are joining in the movement "back to normalcy" and are contributing to the deflation so necessary to the return of activity on the railways and in industry in general.

As noted on a following page, reductions of 10 cents per hour for foremen and of $8\frac{1}{2}$ cents per hour for laborers have been ordered, amounting to decreases of 12 and 15 per cent, respectively. They wipe out the increase given laborers on July 20, 1920, and restore the rates established in supplement No. 8 to General Order No. 27 of the U. S. Railroad Administration. They likewise remove two-thirds of the increase given foremen at the same time. However, the new rates for laborers and for foremen, will be over 150 per cent and 100 per cent greater, respectively, than those prevailing in June, 1915.

The necessity for a reduction in the wages of unskilled labor has been realized for some time, for the rates which the railways have been paying have been widely out of line with those in other industries drawing on the same sources of supply. Contractors and others have been securing their men for 10 to 20 cents per hour less than the roads in almost all parts of the country since the depression set in last fall. This situation has become so acute that a number of roads have contracted certain maintenance operations on a force account basis, paying contractors 10 and 15 cents per hour less for their labor than they were permitted to pay the men directly. While this decision in large measure removes the incentive for this practice it does not entirely eliminate it, for contractors can still secure their labor at rates considerably below those established by the Labor Board. On the other hand, the railways have long suffered from their practice of paying the lowest rates at which they could secure the desired number of men. Some officers have contended that a higher rate which would enable them to enlist more efficient men in their service will be more economical in the end. With the new rate above the prevailing market quotations railway officers now have an opportunity to test out this theory. They will be negligent, indeed, if they do not now exercise the maximum discrimination in the selection of this year's forces.

The Labor Board is to be commended for retaining for the foremen part of the increase given them last July and in this way increasing the spread between the rates paid the foreman and laborers five cents per hour over that paid a year ago. This is a well merited recognition of the fact that maintenance foremen have long been underpaid. It is in the interest of economy to pay a sufficient rate to make the position of foreman sufficiently attractive to enable the roads to recruit and hold men of the requisite ability. It is upon these men that the responsibility for the economical conduct of maintenance work depends in largest measure.

In ordering uniform reductions this decision again emphasizes an inherent defect of our present method of establishing wage rates, because of the utter impossibility of the fixing of uniform rates over a country of as widely varying characteristics as ours, with fairness. While some variation in rates now exists between different areas because of starting with different bases originally, par-

ticularly as between northern and southern roads, an order such as this does not take into account the wide variations in conditions between adjacent localities. Thus the establishment of a uniform rate in the large cities and the country villages alike is in reality discrimination against the former.

Now that this decision has been rendered all uncertainty as to the rates which will prevail during the remainder of the season is removed. With the reductions in wages estimated to aggregate nearly \$150,000,000 in the maintenance department and over \$400,000,000 for all employees, impetus should be given to the season's program of maintenance work.

EXHAUSTING THE POSSIBILITIES

THAT economies can be effected by the use of modern devices or appliances has been demonstrated often; in fact, so often as to be recognized fairly well as a reality. It has also been shown that the saving has been fairly proportional to the degree of interest taken by the men who are most directly concerned with their use or the supervision of their use and repair. The foreman, the supervisor or even the division engineer can often make or break, at least for the time being, the successfulness of mechanical maintenance equipment on his particular road. Aside, then, from the financial question involved in the purchase of labor-saving devices or their first cost, the development of better maintenance methods through the increased use of modern equipment hinges very largely on the maintenance men, from the division engineer down. If opposed by the men or if poor showings are made because of indifference or prejudice, their adoption is retarded and possible economies delayed.

Probably the most conspicuous example of the above has been the development of the tie-tamper—the paint-sprayer is a more recent one. In the case of the tie-tamper its introduction was regarded with disfavor by a large number of foremen and even by roadmasters and higher officers. Of late it has been welcomed on some roads, but that has been chiefly because the men have become interested in it through reading about it or seeing it in actual work on neighboring roads. Other classes of equipment have passed or are now passing through similar experiences. Where such devices have been adopted and maintenance men have become interested and accustomed to their use, they have made good to some degree or other and general maintenance has been benefited correspondingly.

But the mere adoption of some appliance for some specific purpose should not be, by any means, the end so far as that appliance is concerned. There is, first, the need of constant watching and study to make its use still more effective and economical. Second, there are usually other uses for which it is adaptable or to which it can be adapted as a whole or in sections. No one, of all in the maintenance of way department, is better able to get the most out of a piece of equipment than the supervisory officer or the foreman. His problems are before him constantly and he is most familiar with all their phases. Such a man is in the most advantageous position to develop all the possibilities of equipment now in use on his particular road. With the exceptionally wide variety of work called for in the maintenance field there are few, if any, devices that cannot be utilized to advantage for many more purposes than those for which they were originally sold. In maintenance, as in anything else, the possibilities of advanced methods and of more diversified applications of modern equipment are no more exhausted today than they were 10 or 20 years ago.

LETTERS TO THE EDITOR

PROPER MOTOR CAR HEAD LIGHTING A REAL NECESSITY

Duluth, Minn.

TO THE EDITOR:

With the rapidly increasing number and use of railroad motor cars at night come many attendant hazards. It seems, therefore, highly important that very careful consideration should be given to the matter of ways and means of reducing these hazards and preventing accidents.

In a paper read before the National Safety Council by Arthur Ridgway, assistant chief engineer of the Denver & Rio Grande, and reprinted in abstract in the February issue of the *Railway Maintenance Engineer*, this subject is discussed quite thoroughly. In this article Mr. Ridgway points out many causes of and suggests many remedies for the prevention of motor car accidents. He emphasizes quite forcefully the importance of proper protection to cars operating in the daytime, such as flag protection, etc., but it appears from Mr. Ridgway's article that he has given thought only to the hazards of operating cars in the daytime, without consideration to the hazards of night operation and of means of preventing accidents on motor cars operated after dark.

A great majority of the serious accidents occurring at night on railroad motor cars are directly traceable to carelessness in not providing a suitable headlight on the car. Many a motor car is turned over by a derail, or is plunged into an obstruction which is not protected by danger signals because of the lack of a proper headlight.

A motor car, in order to be safely operated at night, should be provided with a headlight capable of projecting a light that will illuminate the track for a distance of at least 200 ft. ahead of the car, and which will at the same time furnish sufficient diffused light to enable the operator to detect any obstructions on a right-of-way of at least four tracks. It also must have a burning capacity of from six to eight hours. A light of this capacity will be amply powerful for the purposes intended and still will not be a blinding one. For tail lighting an ordinary oil burning, red lamp of substantial design, such as used on automobile trucks, has been found quite satisfactory, although with a powerful headlight on a small car a tail light is unnecessary for the beam cast can be seen for a long distance in the rear. Railroad operators have keenly felt the need of a good, reliable headlight for use on motor cars and it has long been acknowledged that the ordinary oil light carried as headlight is not adequate.

It would be well while discussing this subject to consider the hazards in operating at night without a good headlight and to point out the many advantages in a light of the proper type.

1. The use of a good motor car headlight means clear vision on the entire right-of-way on track inspection work.
2. Avoids collisions with obstructions, derails, other motor cars, etc.
3. Gives a clear observation of all signal and mileage posts.
4. Permits reasonable speed with safety.
5. Results in the car being seen by others even from a long distance, whether traveling or standing still.

Many things must be taken into account in selecting the type of light to be used for this particular kind of

illumination. The light must throw its rays equally well when the car is in motion or standing still. The first cost, the cost of operation and the cost of maintaining the lamp must all be within reasonable limits. Like the motor car itself, which is operated by a great many types and classes of officers and employees, the lamp must be of simple construction, easily operated and not readily thrown out of adjustment. The entire equipment required to furnish the light must not be bulky nor must it weigh very much.

Considerable advantage will be obtained if the light is of the type that can readily be removed from the car; in other words, so that it can be used as a hand lantern. There are two good reasons for this:

1. The light may be used in illuminating construction, track and signal repair or inspection work, even after the car has been removed from the track.

2. Many times a light of this kind is used to great advantage in locating engine trouble which may occur after dark.

Much time is lost and energy spent in groping around in the darkness. This results in a vast loss of efficiency and increases greatly the chances of accidents. The importance of providing a good, reliable light for use on motor cars, cannot be over-estimated. Roadmasters, section foremen, signal supervisors, inspectors, and, in fact, every one operating a car at night, either frequently or infrequently, should be provided with proper lighting equipment and while this matter has been investigated and acted upon in a limited way by some of the railroads, there are many others who have apparently paid little or no attention to this vital factor affecting the safety of motor cars operated on their lines.

D. C. DUNCAN,
General Manager, Carbic Manufacturing Company.

NEW BOOKS

Proceedings of the Thirtieth Annual Convention of the American Railway Bridge and Building Association. Edited by the secretary. 248 pages, illustrated. 6 in. by 9 in. Bound in cloth and paper. Published by the association. C. A. Lichty, secretary, C. & N. W. Railway, Chicago.

This volume includes the proceedings of the annual convention which was held in Atlanta, Ga., on October 26-28, 1920. It contains 10 reports and papers, with discussions, including reports of committees on the abuse of treated materials, standard forms for bridge inspection, the repair and maintenance of tank hoops, the use of electricity for pumping, the maintenance of timber docks, spray painting, the maintenance and repair of freight house floors, filling bridges, the reclamation of materials, a paper describing a centralized organization for feeding men by Hunter McDonald, chief engineer of the N. C. & St. L., and a paper on recent developments in concrete, by H. C. Boyden. This volume contains a large amount of valuable information for the railway officer in charge of the maintenance of railway bridges, buildings and water stations. It is printed to the same high standards which have characterized the proceedings of this association in recent years.

HEAVY LOCOMOTIVES.—The several consolidation type locomotives recently built for the Western Maryland at the Baldwin Locomotive Works have again made the question of permissible wheel loading a live issue from the standpoint of maintenance of way. These engines have a total weight of 294,900 lbs., of which 268,200 lb. is carried on four pairs of drivers. Considering this load as equally distributed, this loading gives rise to 67,050 lb. weight on each pair.

LABOR BOARD MAKES \$400,000,000 WAGE CUT

Reductions Ranging From Six to Thirteen Cents Per Hour Will Become Effective July 1

ON JUNE 1 the United States Railway Labor Board announced a decision reducing the wages of railway employees about 12 per cent, effective July 1. It is estimated that this will result in a saving to the railroads of about \$400,000,000 on the basis of the number of persons now employed on the roads. The decision as announced affects 104 railroads which had filed complaints with the board prior to April 18, but, as stated in the decision and in the preliminary announcement made by the Board on May 17, it is the intention to open further hearings on June 6 for the purpose of passing on all of the remaining cases filed so that decisions may also be reached with respect to these that will likewise be made effective July 1. It may be understood in general, therefore, that the wage reductions announced by the Labor Board will be effective with respect to all the railroads and all employees of the classes concerned. The reduction in most cases is expressed in terms of cents per hour to be deducted from the wages in effect as a consequence of the Board's wage increase decision of July 20, 1920, known as Decision No. 2.

The decision of the Board reviews the history of the case and presents a general outline of the reasons governing its finding, chief among which are the reductions in the cost of living and the financial losses which the railroads have suffered as a consequence of the business depression. The Board also calls attention to the necessity for making its decision on the basis of certain standardizations of pay so that the rates of pay for given classes of employees are the same the country over except as the wages paid prior to the wage increase decision of the Board last July were subject to variations in different localities.

In general the reductions range from 6 cents to 13 cents per hour. In the maintenance of way department the reductions are 10 cents for all foremen, assistant foremen and mechanics, 7½ cents for mechanics' helpers, and 8½ cents for track laborers and other common laborers, draw bridge tenders, crossing watchmen, etc. These reductions in relation to the rates of pay prevailing at present and in the past are indicated in the table below:

| I. C. C. Classification of Employees | Average Daily Rate | | Decrease | Per Cent |
|--|--------------------|----------------------|----------|-------------|
| | U. S. Railroad | Pres-ent Labor Board | | |
| | Dec., 1917 | min-istraction Rate | by Board | Basic Wage |
| M. W. and S. foreman..... | \$3.44 | \$5.33 | \$6.53 | \$0.80 12.3 |
| Section foreman | 2.53 | 3.94 | 5.14 | .80 15.6 |
| Masons and bricklayers..... | 3.25 | 4.75 | 5.95 | .80 13.4 |
| Masons' and bricklayers' help-ers | 2.24 | 3.44 | 4.12 | .60 14.6 |
| Painters | 3.47 | 4.93 | 6.13 | .80 13.0 |
| Carpenters | 3.22 | 4.63 | 5.83 | .80 13.7 |
| Structural iron workers..... | 3.58 | 5.44 | 6.64 | .80 12.0 |
| Sectionmen | 1.93 | 3.02 | 3.70 | .68 18.4 |
| Other unskilled laborers..... | 2.24 | 3.27 | 3.95 | .80 20.3 |
| Foremen, construction gang and work trains..... | 3.09 | 4.50 | 5.70 | .80 14.0 |
| Other employees, construction gang and work trains.. | 2.06 | 3.17 | 3.85 | .80 20.8 |
| Crossing flagmen and gatemen | 1.64 | 2.65 | 3.33 | .68 20.4 |
| Draw bridge operators..... | 1.95 | 3.24 | 3.92 | .68 17.3 |

ABSTRACT OF THE DECISION

Immediately after the organization of this Board and on April 16, 1920, it received and took over for hearing a dispute that had been pending before what was known as the Bi-

partisan Board, between a large number of carriers which had been under government control, including most, if not all, of those now before the Board in these cases, and their employees, which dispute, among other things, involved the question of wages.

After a full hearing and as careful consideration as the time and conditions would allow, the Board in that case (Dockets 1, 2 and 3) rendered its Decision No. 2, awarding certain increases and fixing what it deemed just and reasonable wages at that time for all the classes of employees of all the carriers then before the Board. The Board did not then undertake to, and under the law could not, make that decision a permanent award or standard. That decision or award was accepted in good faith and acted on both by the carriers and their employees parties to that decision; and certain other carriers not formerly parties to that case voluntarily applied and put in force the standard of wages fixed by this Board in its Decision No. 2. That decision was rendered at a period of inflation, rising prices and high costs of living. Since then changes, and in some respects very decided changes, have taken place in business, industrial and financial conditions in the United States, and in a varying measure have affected all industries and the entire public.

Confronted by these conditions, the carriers before us, after conferences with the representatives of the different classes of their employees as to a reduction of wages, at which conference there was a failure to reach an agreement, have filed their several complaints and brought their disputes before this Board for a decision as provided by law. The disputes were separately brought; the first being filed by the New York Central Railroad Company on March 19, 1921, followed by numerous other carriers.

The hearings in these cases were completed on May 16, 1921, and the Board has since had the cases before it under consideration. Pending the hearing which commenced on April 18, and since, a considerable number of the carriers before the Board in that hearing have filed with the Board numerous other cases of disputes with other classes of their employees, and other carriers which had no cases pending before the Board on the 18th of April have filed cases of disputes, and such cases are still being received. The Board has been impressed with the belief that a reduction of rates of pay on any road applying to some class or classes and not to others, and thus producing inequalities of treatment and a reduction of wages from the standards fixed by and in Decision No. 2 on some roads, without a corresponding reduction on others operating in the same section and under substantially the same conditions, would possibly be productive of unrest, dissatisfaction and other unfortunate results. It therefore deemed it desirable to render its decision in as many cases and applying to all or as many classes as might come before it at one and the same time and make it effective as of and on the same date. It also deemed it desirable to fix and announce that date in advance so that all parties could in a measure adjust their affairs with that information before them.

With all these things in view, after having considered the evidence heard in the cases before it, the Board on the 17th of May passed and made public a resolution to the effect that it would announce its decision in these cases on June 1, 1921, to become effective July 1, 1921; and it further decided and announced that it set June 6, 1921, as the date for hearing all other like disputes filed, docketed and ready for hearing at that time, it being the purpose of the Board to make its decision of those disputes then heard effective as of July 1, 1921.

In pursuance of this policy and these orders, it now announces its decision in these consolidated cases already heard.

As in Decision No. 2, granting increases in wages, the Board found it necessary to assume a known and recognized base and adopted as such base the rates of wages in effect March 1, the date of the termination of federal control; so in this decision the Board assumes as its base the rates fixed and in effect under and by its Decision No. 2.

It finds that since the rendition of its Decision No. 2 there has been a decrease in the cost of living. What that decrease has been it is impossible to state with mathematical accuracy or even what the general average for the United States has been up to and on any given date. The machinery for pro-

curing and stating with accuracy the data to fix this is by no means perfect. The decreases vary greatly according to the locality, and affect different people in different degrees. In some localities the general decrease has been greater than in others. In the cities the general decreases in some lines have been offset to some extent by the high rents. In some of the items or products that enter into the costs of living the fall in prices has been great; in others, much less.

The Board also finds that the scale of wages for similar kinds of work in other industries has in general been decreased. The same conditions are also found as to this element. It is practically impossible to find any exact average line of decrease for the entire country. The decreases vary in different industries and in different localities, and in some instances with different industries, individuals or corporations. In some places and classes the decrease has been heavy; in others, not so great. There has been a decrease, and the tendency is at present downward. But the most unfortunate condition is that in many localities large numbers are out of employment on account of the prevailing depression, and hence without wages. On these elements and the others prescribed by statute to be considered, the Board has looked to the general conditions existing and brought to its attention, as well as the evidence offered as to particular localities and carriers.

In a decision of this character it is not practical to fix rates applying with exact ratio to each individual employee and each separate locality, for the reason that necessity compels the Board to accept certain standardizations of pay for railroad employees. But these standards are now somewhat different in different regions, and so the decreases will have relatively the same general effect.

The Board believes that based on these elements shown, i. e., the decreased costs of living and the general decrease in the scale of wages in other industries, that the decreases herein fixed are justified and required. But the Board is required by the Transportation Act to consider not one, but all of the seven elements especially mentioned in the act, and other relevant circumstances, and this it has endeavored to do in reaching the results herein announced.

It has endeavored to consider as it should all the elements that enter into this complex problem. There are certain facts and conditions known to all and which can neither be disputed nor ignored. Whatever may be said as to the origin or contributing causes, there has been and is a marked, and to some extent distressing and disastrous, depression in business and industry affecting the entire country and some lines of production most seriously. As a result heavy financial losses have been suffered and many hundreds of thousands thrown out of employment and deprived of all wages, and this loss of purchasing power by them has in turn accelerated the general depression by reducing the demand for the products they would otherwise have purchased. While it has been argued that the fall in prices has not reached to any large extent the consumer, it has without question most disastrously reached and affected the producers, especially some lines of manufacture and the agricultural classes.

It should be recognized by all that the problem before us is chiefly an economic one, and we are all confronted by adverse and troublesome conditions which everyone must help to solve. It should not be looked upon as a struggle between capital and labor, or the managements and the employees.

DECISION

The Labor Board decides:

1. That the rates of wages heretofore established by the authority of the United States Railroad Labor Board shall be decreased as hereinafter specified, and that such decreases shall be effective as of July 1, 1921.

2. That the scope of this decision is limited to the carriers named, to such carriers as may be included hereafter by addenda, and to the specific classes of employees named or referred to under each particular carrier.

3. That the reduction in wages hereby authorized shall be made in accordance with the following articles which prescribe the regulations, designate the employees affected, and establish the schedules of decreases.

MAINTENANCE OF WAY AND STRUCTURAL AND UNSKILLED FORCES SPECIFIED

For the specific classes of employees listed herein and named or referred to in connection with a carrier affected by this decision, use the following schedules of decreases per hour:

Sec. 1. Bridge, building, painter, construction, mason and concrete, water supply, and plumber foremen (except water supply and plumber foremen coming under the provisions of shop employees).....10 cents.

Sec. 2. Assistant bridge, building, painter, construction, mason and concrete, water supply, and plumber foremen, and for coal wharf, coal chute, and fence gang foremen, pile driver, ditching and hoisting engineers and bridge inspectors (except assistant water supply and plumber foremen coming under the provisions of shop employees).....10 cents.

Sec. 3. Section, track and maintenance foremen, and assistant section, track and maintenance foremen.....10 cents.

Sec. 4. Mechanics in the maintenance of way and bridge and building departments (except those that come under the provisions of the national agreement with the Federated Shop Trades).....10 cents.

Sec. 5. Mechanics' helpers in the maintenance of way and bridge and building departments (except those that come under the provisions of the national agreement with the Federated Shop Trades).....7½ cents.

Sec. 6. Track laborers, and all common laborers in the maintenance of way department and in and around shops and roundhouses, not otherwise provided for herein....8½ cents.

Sec. 7. Drawbridge tenders and assistants, pile-driver, ditching and hoisting firemen, pumper engineers and pumpers, crossing watchmen or flagmen, and lamp lighters and tenders8½ cents.

Sec. 8. Laborers employed in and around shops and roundhouses, such as engine watchmen and wipers, fire builders, ash-pit men, flue borers, coal passers (except those coming under the provisions for engine and boiler house, this decision), coal chute men, etc.....10 cents.

SIGNAL DEPARTMENT EMPLOYEES

For the specific classes of employees listed herein and named or referred to in connection with a carrier affected by this decision, use the following schedules of decreases per hour:

Sec. 1. Signal foremen, assistant signal foremen, and signal inspectors8 cents.

Sec. 2. Leading maintainers, gang foremen, and leading signalmen8 cents.

Sec. 3. Signalmen, assistant signalmen, signal maintainers, and assistant signal maintainers.....8 cents.

Sec. 4. Helpers6 cents.

(Among the employees of other departments it is of interest to note that supervisory clerks and clerks employed over two years have been reduced 6 cents per hour; clerks employed more than one year and less than two years, 13 cents, and clerks less than one year, 6½ cents. Telegraphers, agent operators, etc., have been reduced 6 cents and agents at non-telegraph stations 5 cents. Engine employees in passenger service have been reduced 48 cents per day and those in freight service 64 cents per day. Trainmen in passenger service have been reduced 60 cents per day and in freight and yard service 64 cents.)

MISCELLANEOUS EMPLOYEES

For the miscellaneous classes of supervisors and employees not specifically listed under any article, named in connection with a carrier affected by this decision, use the following rule for making decreases:

Sec. 1. For miscellaneous classes of supervisors and employees in the hereinbefore named departments properly before the Labor Board and named in connection with a carrier affected by this decision, deduct an amount equal to the decreases made for the respective classes to which the miscellaneous classes herein referred to are analogous.

Sec. 2. The intent of this article is to extend this decision to certain miscellaneous classes of supervisors and employees submitted by the carriers, not specifically listed under any section in the classified schedules of decreases, and authorize decreases for such employees in the same amounts as provided in the schedules of decreases for analogous service.

GENERAL APPLICATION

The general regulations governing the application of this decision are as follows:

Sec. 1. The provisions of this decision will not apply in cases where amounts less than \$30 per month are paid to individuals for special service which takes only a part of their time from outside employment or business.

Sec. 2. Decreases specified in this decision are to be deducted on the following basis:

(a) For employees paid by the hour, deduct the hourly decrease from the hourly rate.

(b) For employees paid by the day, deduct eight times the hourly decrease from the daily rate.

(c) For employees paid by the month, deduct 204 times

the hourly decrease from the monthly rate.

Sec. 3. The decreases in wages and the rates hereby established shall be incorporated in and become a part of existing agreements or schedules, or future negotiated agreements or schedules, and shall remain in effect until or unless changed in the manner provided by the Transportation Act, 1920.

Sec. 4. It is not intended in this decision to include or make decreases in wages for any officials of the carriers affected except that class designated in the Transportation Act, 1920, as "Subordinate Officials," and who are included in the Act as within the jurisdiction of this Board. The Act provides that the term "Subordinate Officials" includes officials of carriers of such class or rank as the Interstate Commerce Commission shall designate by regulation duly formulated and issued. Hence, whenever in this decision words are used, such as "foremen," "supervisors," etc., which may apply to officials, such words are intended to apply to only such classes of subordinate officials as are now or may hereafter be defined and classified by the Interstate Commerce Commission as "subordinate officials" within the meaning of the Transportation Act, 1920.

INTERPRETATION OF THIS DECISION

Should a dispute arise between the management and the employees of any of the carriers as to the meaning or intent of this decision, which cannot be decided in conference between the parties directly interested, such dispute shall be referred to the United States Railroad Labor Board in the manner provided by the Transportation Act, 1920.

Sec. 1. All such disputes shall be presented in a concrete and joint signed statement setting forth:

(a) The article of this decision involved.

(b) The facts in the case.

(c) The position of the employees.

(d) The position of the management thereon.

Where supporting documentary evidence is used it shall be attached to the application for decision in the form of exhibits.

Sec. 2. Such presentations shall be transmitted to the Secretary of the United States Railroad Labor Board, who shall place same before the Labor Board for final disposition.

By order of

UNITED STATES RAILROAD LABOR BOARD,
R. M. BARTON, Chairman.

Attest:

C. P. CARRITHERS, Secretary.

THE EMPLOYEES' ARGUMENTS

The hearing upon which the Board based its decision was completed on May 16 after hearing the employees' side and the carriers' rebuttal. The presentation of the railway or employers' side was completed on April 20 and a synopsis of the arguments presented was published in the *Railway Maintenance Engineer* for May. On April 28 the employees' side of the case was taken up, the presentation being opened by B. M. Jewell, spokesman for the labor organizations. The defense of the justness and reasonableness of the prevailing rates of pay was based largely on (1) the fact that there had been no decrease in the wages of the workers in the coal and steel industry, (2) that the railroads were alleged to be grossly mismanaged and that economies sufficient to place the railroads on a sound financial basis could be accomplished without reductions in wages, (3) that the decrease in cost of living does not justify wage reductions at this time.

Most voluminous testimony was offered by W. Jett Lauck, consulting economist for the employees' representatives, who took the position that the Board must take into account what he termed "the fundamental principles of industrial liberty, of human well-being, of public policy, etc." He contended that the Board must distinguish between wages based on the cost of living and wages "that will provide a decent living and secure for the children of wage earners opportunity for education," or, as he stated at another time, that would enable the employees "on a full time working basis to support their families in a manner which enlightened public opinion in this country would accept as minimum standards of health and decency."

The chief contention, however, of Mr. Lauck's testimony was that the railroads were inefficiently financed, managed and operated and that if these deficiencies were corrected, it would not be necessary to resort to wage reductions. This he summarized as follows:

"In meeting this general issue, I think, the statement would be accepted by all right-thinking persons that if deflation in the operating expenses of the railroads is necessary, the rates of pay of employees or labor costs should be the last item changed. As a consequence, when the question of deflation or reduction in costs becomes uppermost, the first method of proper procedure would be to ascertain whether other factors affecting operating costs which are not directly concerned with human welfare may not be subject to advantageous changes so that operating expenses may be lessened.

"From our point of view, therefore, we hold and will submit exhibits to show that this Board cannot take up the question of a reduction in rates of pay until it has satisfied itself as to two fundamental points:

"1. Are the railroads being managed and operated with reasonable economy and efficiency; and

"2. Is the present plight of the railroads due to the inadequacies of management, to the inefficiency of railroad labor, or to an increase in labor costs which have been caused by rates of pay established by the Board in its Decision Number 2?"

These conclusions were supported by most voluminous exhibits designed to point out the inefficiencies of the railroads as a basis of which it was contended that the railroads could accomplish savings of \$3,376,355,000 annually! One basis for these estimates were articles taken from the *Railway Maintenance Engineer*, the *Railway Age* and other publications, showing savings accomplished by the introduction of improved methods, and then assuming that these methods if applied to all the railroads of the country would have resulted in proportionate economies.

Testimony was presented at some detail in opposition to the suggestion for reducing wages on the basis of the reduction in the cost of living. It was contended that prices normally decline in the spring and also that the present depression in industrial and commercial conditions represent the lowest possible level and that with readjustment prices of commodities and, therefore, the cost of living will rapidly be adjusted upward. It was also contended that the increase in rents taking place in the last six months will largely neutralize any reductions in the cost of food and clothing.

NEW CLASSIFICATION OF RAILWAY OCCUPATIONS

The United States Railroad Labor Board has completed an entirely new classification of all forms of employment on the railroads which has been made effective by the Interstate Commerce Commission under an order dated April 18 and will be used by the carriers in reporting the service and compensation of their employees to the commission and to the Labor Board. The purpose of this classification is to furnish a basis for the collection of wage and other data and to establish as nearly as possible a uniform terminology that may be used in describing similar positions. The Board stated specifically in announcing this classification that it should not be considered by the railroads or others interested as setting up jurisdictional lines for occupation or as limiting the kinds of work which employees may perform.

Under this new classification the employees are divided into main divisions of employment which are called *services*, this subdivision being largely along departmental lines. These *services* are subdivided into *groups* of related positions covering work which is generally performed by the same profession or trade. Within these groups are also separate grades and class groups. The total classification of the services outside of the service of executives, officers and assistants, provides for 500 distinct classes of employment.


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NOW WORKING 10 HOURS \$533 SUNDAYS
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IN THE JUNE, 1920, issue of the *Railway Maintenance Engineer* there was an article entitled "Studying the Labor Turn-Over," which described in detail a plan inaugurated by a western railroad to collect statistics reflecting the frequency of maintenance labor turn-over. The plan in question was placed in operation on April 1, 1920, and statistics for the nine months' period ending December 31, 1920, have now been compiled. These statistics cover only men employed through the employment bureau of this road, no data having been collected concerning the men picked up by foremen in the localities in which they were working. As the period which these figures cover was one of extreme labor shortage in the territory this road serves, the number of men employed in this way was very small, it being doubtful if as much as one per cent of the total number of men hired during this period was secured through other means than the employment bureau.

Maintenance forces have been divided, for the purpose of this report, into extra gang laborers, section gang laborers, carpenters and carpenter helpers. Results of the survey have been shown in two ways: first, the average number of man-days service based on the number of men employed and the average number of man-days service based on the number of men who actually gave service; and second, the number of men giving service in various group periods. This second method of showing the duration of stay is unusual in statements of this kind, but it is believed by the compiler that the information shown in this manner more clearly reflects the results that are being obtained through the operation of the employment bureau than does the usual method of stating the average number of man-days service.

LABOR TURN-OVER STATISTICS, APRIL 1, 1920, TO DECEMBER 31, 1920

EXTRA GANG LABORERS

| | |
|---|-------|
| Total number employed during period..... | 890 |
| Did not report for work or did not work after reporting.. | 579 |
| Total number employed during period who gave service. | 311 |
| Total number of man-days service given..... | 7187 |
| Average number of man-days service based on number of men employed | 8.075 |
| Average number of man-days service based on number of men who actually gave service | 23.10 |

MAINTENANCE LABOR TURN-OVER STATISTICS

Employment Bureau of Western Railroad Makes Enlightening Compilation of Its Operations

BY WILLIAM S. WOLLNER

DURATION OF STAY BY PERIODS

| | |
|---------------------|-----|
| 1 to 10 days..... | 108 |
| 11 to 20 days..... | 78 |
| 21 to 31 days..... | 48 |
| 1 to 2 months | 60 |
| 2 to 3 months | 9 |
| Over 3 months | 8 |

Total 311

Of the men in the above statement, the following were still in the service December 31, 1920:

| | |
|---------------------------------|---|
| Less than 1 month service | 3 |
| 1 to 2 months' service | 7 |
| 2 to 3 months' service | 2 |
| 3 to 4 months' service | 2 |
| 4 to 5 months' service | 4 |

Total 18

SECTION GANG LABORERS

| | |
|---|-----|
| Total number employed during period | 401 |
| Did not report for work or did not work after reporting.. | 247 |

Total number employed during period who gave service. 154

| | |
|--|-------|
| Total number of man-days service given | 4172 |
| Average number of man-days service based on number of men employed | 10.40 |
| Average number of man-days service based on number of men who actually gave service..... | 27.09 |

DURATION OF STAY BY PERIODS

| | |
|---------------------|----|
| 1 to 10 days | 62 |
| 11 to 20 days | 32 |
| 21 to 30 days | 22 |
| 1 to 2 months | 21 |
| 2 to 3 months | 8 |
| 3 to 4 months | 5 |
| Over 4 months | 4 |

Total 154

Of the men in the above statement, the following were still in service December 31, 1920:

| | |
|-------------------------|---|
| Less than 1 month | 3 |
| 1 to 2 months | 3 |
| 2 to 3 months | 5 |
| 3 to 4 months | 4 |
| Over 4 months | 3 |

Total 18

CARPENTERS

| | |
|---|----|
| Total number employed during period | 51 |
| Did not report for work or did not work after reporting.. | 17 |

Total number employed during period who gave service.. 34

| | |
|---|-------|
| Total number of man-days service given..... | 1275 |
| Average number of man-days service based on number of men employed | 25 |
| Average number of man-days service based on number of men who actually gave service | 37.50 |

DURATION OF STAY BY PERIODS

| | |
|---------------------|----|
| 1 to 10 days | 8 |
| 11 to 20 days | 10 |
| 22 to 30 days | 7 |
| 1 to 2 months | 4 |
| Over 2 months | 5 |

Total 34

(A Front)

R. R. B.

EMPLOYMENT BUREAU

A. B. & C. RAILROAD

64 Pine Street

San Francisco, Cal.

(B Reverse)

Signature _____

Reasons for above _____

Charge for above _____

Weather _____

Food _____

Discharged with _____

Rate of pay _____

Wishes to move on _____

Discharged _____

Reduction of hours _____

Other reasons below _____

This man left service:

192

(C Front)

R. R. B.

EMPLOYMENT BUREAU

A. B. & C. RAILROAD

64 Pine Street

San Francisco, Cal.

(D Front)

Length of Service _____

Date Left Service _____

Date Reported _____

Date Shipped _____

As _____

Shipped to _____

Occupation _____

Name _____

Index No. _____

Gang No. _____

YEAR _____

MONTH _____

DAY _____

(A Reverse)

EMPLOYMENT BUREAU

This card will introduce:

This man has been employed for work in your gang. He has signed a hospital agreement. When this man reports for work, please return this card by railroad mail, keeping attached card until he leaves the service when it should also be mailed to me by railroad mail.

(B Front)

R. R. B.

EMPLOYMENT BUREAU

A. B. & C. RAILROAD

64 Pine Street

San Francisco, Cal.

(C Reverse)

The man whose name is given below was hired for service in your gang:

If this man does not report for work, please return this card with information to that effect written on it to the Employment Bureau, 64 Pine Street, San Francisco, California.

(D Reverse)

The Front and Reverse Sides of a Folding Record Card

Of the men in the above statement, the following were still in service December 31, 1920:

| | |
|-------------------------|---|
| Less than 1 month | 2 |
| 2 to 3 months | 2 |
| Over 3 months | 2 |
| Total | 6 |

CARPENTER HELPERS

Total number employed during period 171

Did not report for work or did not work after reporting... 94

Total number employed during period that gave service. 77

Total number of man-days service given 1822

Average number of man-days service based on number of men employed 10.65

Average number of man-days service based on number of men who actually gave service 23.66

DURATION OF STAY BY PERIODS

| | |
|---------------------|----|
| 1 to 10 days | 25 |
| 12 to 19 days | 24 |
| 21 to 30 days | 11 |
| 1 to 3 months | 13 |
| Over 3 months | 4 |

Total 77

Of the men in the above statement, the following were still in service December 31, 1920:

1 to 3 months 2

One of the primary purposes of this labor turn-over survey was to determine the principal causes for men

leaving the railroad's service so that, if practicable, the conditions responsible for the heavy turn-over could be corrected or modified. Of the 1,513 men hired by the employment bureau during the nine months' period which figures cover, 937 gave no service. Of these 937, 744 did not report on the job and foreman failed to give reasons why 306 additional men quit. It is possible, therefore, to show reasons for only 463 men leaving the service. As shown in the article in the June, 1920, issue of the *Railway Maintenance Engineer*, 12 causes for leaving the service were enumerated on the card furnished foreman for reporting turn-over statistics. The reasons for leaving the service as given by foreman for the classes of employees covered by these statistics (extra gang laborers, section gang laborers, carpenters, carpenter helpers) are tabulated as follows:

REASONS FOR LEAVING

| | |
|---|------|
| Did not report on job | 744 |
| Gave no reason | 306 |
| Wanted to move on | 182 |
| Discharged | 73 |
| Weather conditions | 31 |
| Reduction of forces | 30 |
| Had another job | 26 |
| Quarters | 23 |
| Rate of pay | 20 |
| Could not mix in gang | 17 |
| Dissatisfied with food | 11 |
| Work was too hard | 8 |
| Sickness | 7 |
| Had no blankets | 7 |
| Reduction of working hours | 6 |
| Had no rainclothes | 5 |
| Insufficient earnings | 3 |
| Hours | 2 |
| Charge for board | 2 |
| Claimed there was not enough to eat | 1 |
| Insane | 1 |
| Poison oak | 1 |
| Not feeling well | 1 |
| No mattress | 1 |
| Sickness in family | 1 |
| Did not like railroad work | 1 |
| Had no funds for board at hotel | 1 |
| Epileptic fits | 1 |
| Dissatisfied with job | 1 |
| Total | 1513 |

IMPROVED FORM OF RECORD CARD

As the forms used in gathering these statistics, as shown in the previous article, were entirely original and not based on previous experience, it was natural that ways in which they could be improved developed with their use. The three cards used for gathering these statistics, (a) office record card, (b) card of introduction to foreman, and (c) foreman's report of man's leaving service, had to be filled in individually and this proved to be quite an operation when, as was the case, as many as 50 men a day were employed. Incidentally the foreman's return of card (b) to the employment bureau was the only means of knowing whether the man reported for duty. If this card was not returned promptly, it was assumed that the man had not reported for work, although, as it developed in many cases, the man had reported but the foreman had failed to return the card to the employment bureau.

The form shown in the illustration was put into use on January 1, 1921, and, as will be noted, consists of four cards 5 in. by 3 in., printed on a sheet 5 in. by 12 in. This sheet is so arranged that it may be folded and all the information required typed on the four cards with one impression. In the new form, (a), which is at the top of the sheet, serves the same purpose as card (b) in the old form, that is, it is handed to the laborer to be used as an introduction to the foreman to whom he reports. Card (b) is similar to card (c) in the old form

and is used exactly the same manner for advising the employment bureau when the man leaves the company's service and the reason for his quitting. Card (c), which was not used in conjunction with the old form, is mailed to the foreman immediately upon the man's being employed so that the foreman may be advised of the progress that is being made in supplying his gang with men. It will be noted that in accordance with instructions printed on this card the foreman returns it to the employment bureau if the man does not report for service, thus permitting the employment bureau to maintain its records and to supply another man in this man's place. Card (d), which is the compilation card retained in the files of the employment bureau, is exactly the same as card (a) in the old form.

While the figures herein presented are believed to be accurate, it is assumed that more valuable data can be compiled as foremen, who must be depended upon for part of the data, become more familiar with the forms.

The period, which figures contained herein cover, was one of acute railroad labor shortage, whereas, the period immediately following has been one in which labor conditions have made available many more men than could be used in railroad maintenance service. Additional statistics will, therefore, be compiled at a later date so that comparison of data for the two periods may be had.

"I THINK THAT YOU CAN STILL GET BY"

ADVERSE condition loudly cries for us to all economize. To get together, buck the slump and save our railroads from the dump. *The less you love your little job, the larger grows the idle mob.* Unless you act, this term "adverse" will keep on getting worse and worse.

We had a war and all got stewed on "hootch" that Bill, the Kaiser, brewed, and in this wild and woolly brawl we got so full we couldn't crawl. We whooped her up and tore our shirt. We gave and spent "until it hurt." We tossed our dollars in the air and let them land most anywhere. When Fritz took his final flop, us birds just simply couldn't stop. Now, sick and sore we go to bed and nurse an awful, awful head.

Old "Doctor Reason" comes to us, with all our bell-ache and fuss. He lifts our grimy, shaky paw and pumps the sludge from out our craw. Then seats himself upon our bunk and analyzes all this junk. In a dim, mysterious, hazy way, we hear the old guy softly say:

"Collectively, I'll bawl you out; so in your mind, there'll be no doubt as to the cause of all your pain and maybe you won't slip again.

"While Tom and Dick and Jim and Jud were 'over there' in Flander's mud, you stayed at home and copped the Kale, and some of you should be in jail. Devoid of reason, sense or fear, you helped along the profiteer. The cost of things—that cut no ice—you bought and bought and paid the price. You sold your 'bonds' and hocked your 'stamps' and blew it in upon the Vamps. You could not sense these days so lean, when you were burning gasoline. When you were asked to please produce, you sputtered out, 'Oh, what's the use.' You loafed and stalled and dodged the boss and now have *Economic Loss*.

"You now stand by the River Styx and you are in some damn bad fix. You can't crank up the Henry now, load in the children and the frau and wave a silk-cuffed hand at Fate as you sail gaily out the gate. The country's going on the blink; our ship of state is going to sink unless out of that cot you fall, spit on your hands and hit the ball.

"I spoze I'll have to help you live, so a simple powder I shall give. One-half of it is common sense; the other half is confidence. If you'll take this and really try, I think that you can still get by."

W. H. F.

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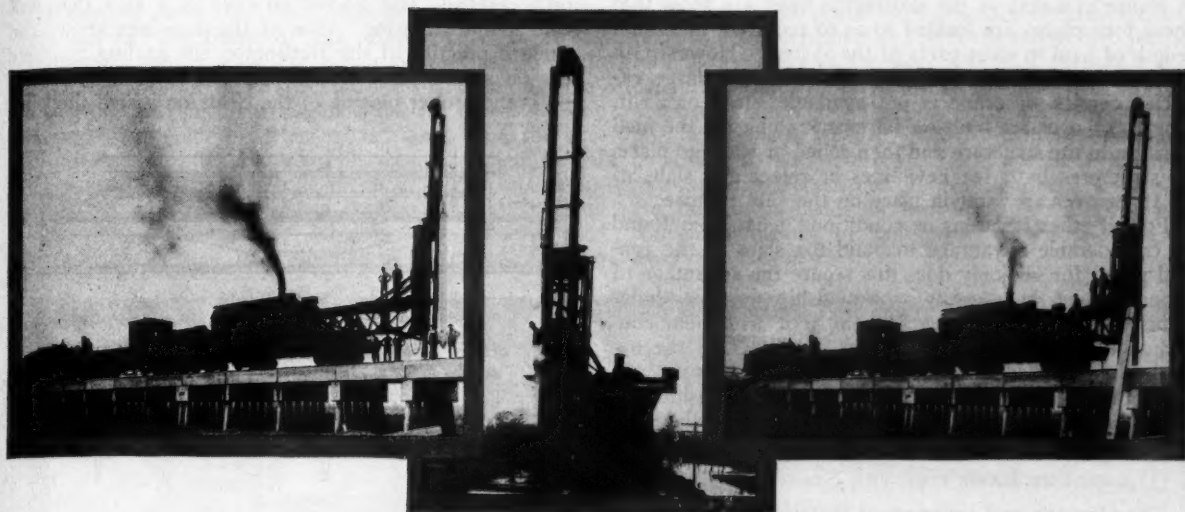
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HOW CONCRETE PILE TRESTLES ARE BUILT

Fourteen Years of Construction Experience on the Burlington
Has Developed Well Established Practices

THE RAILROADS of the middle west were the first to take up the use of reinforced concrete and have likewise made the most extended application of this valuable construction material. It was natural, therefore, that the reinforced concrete trestle, which lends itself naturally to the low flat waterways which prevail in the Central states, should receive its earliest and widest use in this portion of the country. Thus, the Chicago, Burlington & Quincy, which in 1907 built the first reinforced concrete pile trestle to be constructed on any railroad, now has more than 15 miles of reinforced concrete trestles under its tracks. The Chicago, Milwaukee & St. Paul, the Illinois Central, the Wabash and a number of other lines have also gone extensively into the use of this form of construction, both with the concrete pile bents and the thin reinforced concrete piers. As a consequence designing practice has become standardized and now gives rise to little discussion. It is in the construction methods that the development in recent years has been most pronounced and has withal received the least attention in published articles or reports before technical associations. In view of the fact that enough years have now elapsed to demonstrate the permanence of this construction beyond any question, it is not unlikely that a more extended use will be made of it in the future. Consequently, the engineering officers of many roads who have lately considered the use of this form of construction will be particularly interested in an account of the methods pursued by the Burlington in building these trestles, particularly those embodying the use of the reinforced concrete pile.

THE PILE TRESTLE IS MORE ECONOMICAL

Within the scope of its admissible use the reinforced concrete pile trestle is cheaper than the trestle embodying the use of the solid piers. Consequently, the pile trestle is favored wherever it may be used legitimately, that is, where the driving of piles is possible and the distance from the ground line to the rail level does not exceed 16 ft. This has been considered the reasonable safe limit for the stability and column strength of the

piles. In the pile trestles the span length or bent spacing is usually made about the same as that of the timber pile trestle being replaced so that the new concrete bents may be driven between the old bents and capped without interference with the existing structure. For those cases where the pile bents cannot be used, the reinforced concrete piers on rock or pile foundations are substituted. These are more expensive. Consequently, it is found more economical to use longer span lengths, and slabs up to 25 ft. in length are frequently built. For the purpose of avoiding interference with the existing structure, the slabs are often made of irregular lengths or of a combination of span lengths. Also, when conditions permit, combinations of the solid piers and concrete pile bents are utilized as shown in the small sketches. When spans of 20 ft. or over are to be supported on the pile bents, double bents are required. These are also introduced in the pile trestles of ordinary length spans for every fifth bent as a means of providing additional stability against the longitudinal forces.

THE PILES ARE SQUARE

The earlier pile trestles had cast octagonal piles. Later the rolled Chenoweth patented pile was used, but for a number of years a square cast pile, 14½ in. on a side with edges turned on a 1⅝-in. radius, has been the standard. These piles are reinforced with a single ½-in. square bar in each corner, the four bars being enclosed in a single wrapping of American Steel & Wire triangular mesh No. 23 placed with the main reinforcement parallel to the axis of the pile. The bottom of the pile is finished with a short truncated cone.

The slabs have been standardized in lengths of 14, 15, 16, 20 and 25 ft., although odd lengths are frequently used. The slabs are 7 ft. wide, so that two are required to each span for a single track.

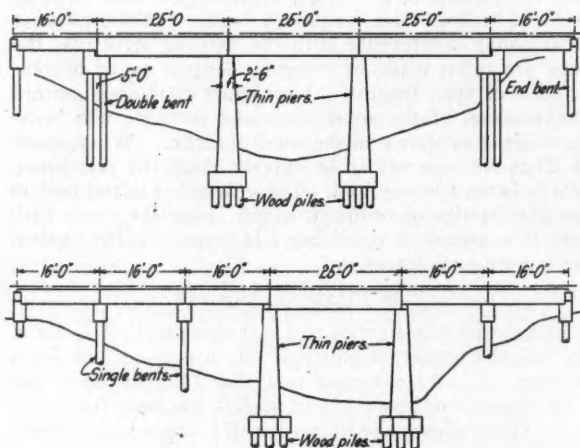
A very important element in the successful use of this type of construction by the Burlington lies in the manufacture of all of the piles and most of the slabs at four concrete plants maintained by the road at Galesburg, Ill., Hannibal, Mo., Havelock, Neb., and Bridgeport, Neb.

A glance at a map of the Burlington lines will show that these four places are located so as to require a minimum length of haul to most parts of the system. However, in case that the site of the bridge is such that a large capacity derrick or crane is not available, slabs of 25-ft. lengths or over are built on falsework alongside the final position in the structure and then rolled or slid into place. In structures built for new lines or relocation, slabs of 20 ft. or over are built in place on the substructure.

For all other locations or conditions it has been found of considerable advantage to build the slabs at the central plant, for not only does this secure the advantage of economy and high grade workmanship possible under industrial plant conditions as compared with field construction, but there is the further advantage in the opportunity afforded to accumulate a surplus of piles and slabs during slack times. Consequently, a considerable supply of these units is generally available when the construction season opens in the spring.

THE LAYOUT OF THE STRUCTURE

The planning and ordering of material for a concrete trestle is a more exacting problem than that involved in layout of a frame or wooden pile trestle. Wooden piles or posts are readily cut off if too long and stringer span lengths can easily be shortened if the bents are not placed at the established positions. With a concrete trestle the bents must be located accurately and the length of piles must be determined as closely as possible. To this end a location plan is prepared, showing the spacing of all existing pile bents and all pile stubs. In addition the distance from the base of rail to the ground line is determined at each bent. With this information as a basis, the new trestle is set in with all the new bents accurately located. This plan is then sent to the master carpenter, who takes it to the site of the bridge and estimates the length of piles for each bent, based usually on the pile driving records for previous struc-

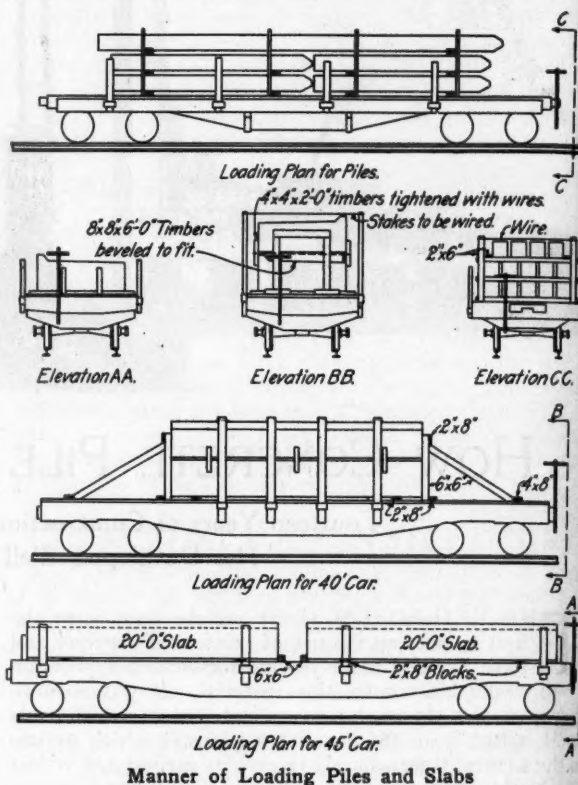


Typical Trestle Layouts for Small Openings

tures at the same site. Occasionally it is found necessary to make some test borings or even drive some test piles. Piles ordered on estimates of the length so made usually may be driven without excessive cutting, but if the driving of the first piles indicate that the piles ordered for the bridge are too short or too long, they may be quickly replaced from the stocks at the concreting plants by new ones of modified lengths.

Concrete piles obviously cannot be handled in the rough manner that is customary in the loading and unloading of wooden piles. Instead, they must be picked up and set

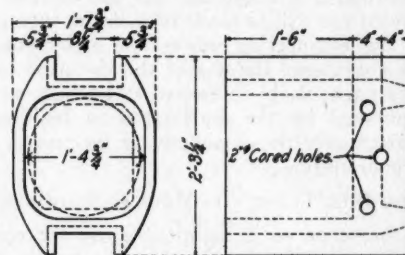
down carefully and loaded on cars in a way that will avoid undue stressing. One of the drawings shows the standard practice of the Burlington for loading concrete piles on cars. Of particular importance in this connection is the proper placing of the cleats on which the piles



rest. These have a tendency to shift under traffic and must in consequence be wired securely to the stakes. The piles are not loaded out for use until they have been cured at least 30 days in summer time or at least 45 days in cold weather. Under the usual circumstances of manufacture, however, most of the piles are subjected to a much longer period of curing before it is necessary to send them out.

PILE DRIVING MOST EXACTING WORK

The driving of reinforced concrete piles imposes much more exacting requirements on the equipment and on the force carrying out the work than does the driving of wooden piles. The success of this form of construction, both from the standpoint of economy and of permanence,

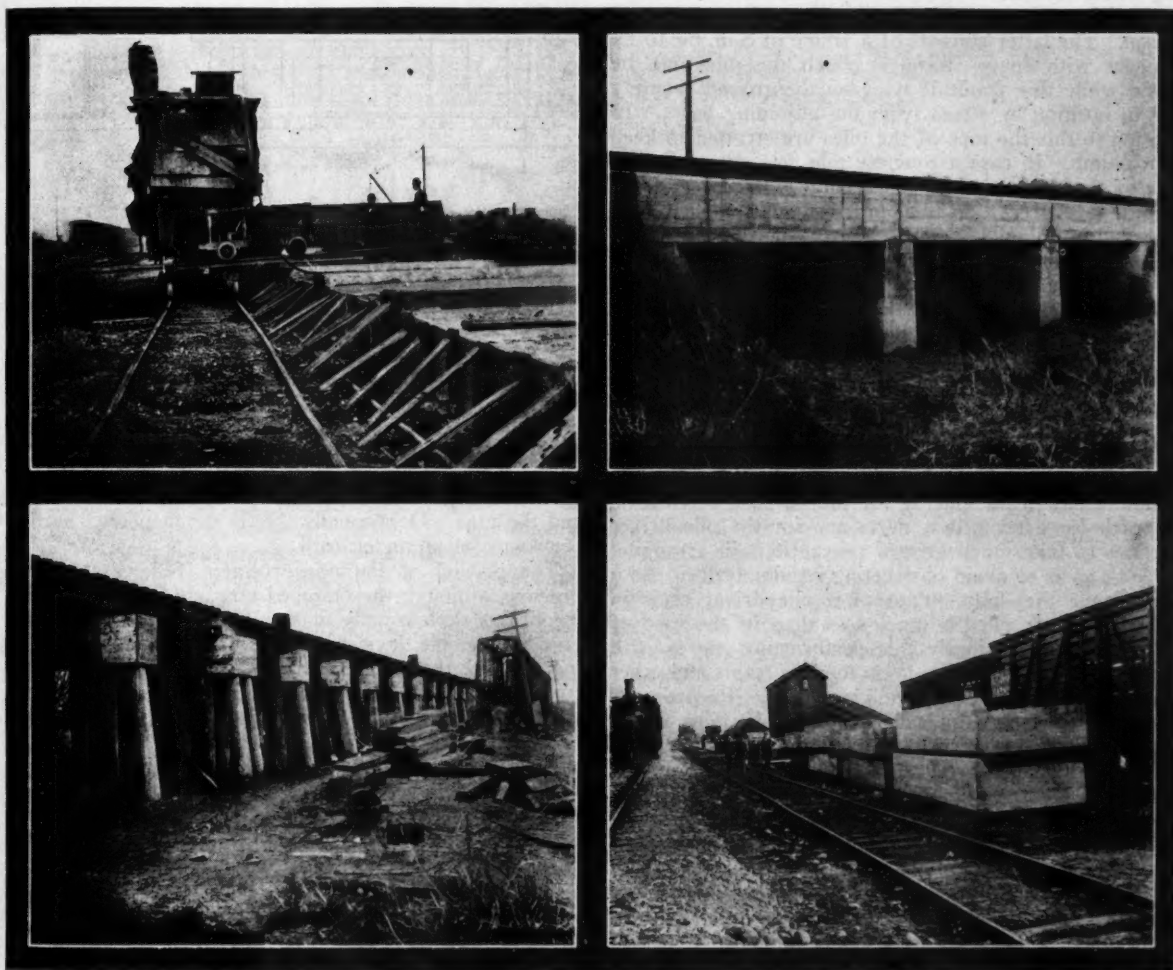


Driving Head for Concrete Piles

depends to a greater extent on the care and efficiency with which the pile driving is done than on any other feature of the construction. In the case of the equipment it is not only necessary that the driving power be

sufficient to force the larger blunt-pointed piles into the ground, but the frame of the driver must be strong enough to handle piles that weigh as much as 6,800 lb. Concrete piles on the Burlington are driven by all-steel, self-propelled pile drivers with either the steam or drop hammer, although experience has shown that the best results are usually secured with the steam hammer of the size equivalent to a Vulcan No. 2. With this equipment the piles are ordinarily driven with less damage than with a drop hammer. Owing to the fact that concrete is not capable of withstanding the effect of sharp

In sand or fine gravel, it is generally necessary to use a jet, this being accomplished with the aid of two jet pipes on opposite sides of the pile. For this purpose a pump delivering water to a four-inch discharge pipe at 125 lb. pressure is provided. The four-inch line is carried to the pile, where it is divided into two-inch lines connected by a hose to the jet pipes. These are 30-ft. lengths of two-inch pipe, reduced at the lower end to a $\frac{3}{4}$ -in. diameter hole and with the top bent into a gooseneck to afford convenient means for handling it with a pile line or a block and tackle.



Typical Stages in the Building of Concrete Trestles

*Concreting the Slabs
Completed Bents Between the Wooden Bents*

*A Trestle With Solid Piers
Slabs Ready to Be Erected*

impact as well as wood, it is necessary to protect the head of a concrete pile by means of a special driving head like the one shown in the drawing. This is not unlike the ordinary driving head used with wooden piles except that the recess for the head of the pile is much larger, affording ample room to receive the full top of the pile as well as a cushion made of one or more layers of plank, frayed rope or worn out brake hose.

Except where conditions are exceptionally severe this driving head and its cushion will protect the pile head against injury. In case the top of the pile does begin to spall, it is customary to cut off the injured portion of the pile, including the projecting portions of the bars, and then proceed with the driving of the newly formed top.

In the semi-arid portions of Nebraska, Wyoming and Colorado a dry clay or disintegrated shale is sometimes encountered that is especially resistant to the driving of concrete piles. Jetting is of little benefit and the steam hammer is not effective. For this reason it is necessary to use a drop hammer weighing about 4,100 lb., but in many cases the pile cannot be driven at all without preparing a hole for it by a churning process. For this a wooden pile, with a cast-iron shoe or plunger secured to the bottom of it, is tied to the hammer and then jogged up and down to form the hole. Water is usually added to soften up the material while this process is being carried on. In using the drop hammer for driving the concrete piles, no greater drop of the hammer is taken than

necessary to get the penetration, since the damage to the pile is increased appreciably as the fall is increased.

While no effort is made to keep the pile from twisting so that the sides of the pile are out of square with the bents, it is highly important that the piles be plumb and properly spaced in the bent. Similarly the bents must be square with the track and properly spaced. Owing to the fact that the concrete pile cannot be bent into line after driving like a wooden pile, greater precautions are taken to keep it in position while the driving is in progress. Piles driven on slopes are best kept in line by digging a hole several feet deep for the piles before attempting to drive. On more level ground a "checker board" is used. The latter consists of a frame of 8-in. by 16-in. stringers with spaces through which the piles can be driven while this frame is lying on the ground securely held in position by struts from the adjoining bents. In addition to this the tops of the piles are strutted to keep them plumb. In case a concrete pile gets out of line in spite of these precautions, the ground is dug away from one side to as great a depth as practical and the pile pulled or jacked into line.

Considerations of stability and strength demand that the center line of the cap and the center line of the joint between adjoining slabs shall be as nearly as possible coincident with the center line of the piles in the bent and the construction forces are not permitted to offset the cap to correct any inaccuracy in the pile driving. If the location of the bent is off more than three inches, special length slabs are ordered to fit.

Owing to the fact that the driving of concrete piles is slower than that of wooden piles and that the concrete cannot be sawed off quickly for the purpose of clearing the track for a train, it is necessary for the pile driver foreman to take much greater precautions in arranging his work so as to avoid obstructing regular traffic. As a consequence the daily output of a pile driver crew in driving concrete piles is much less than in the case of wooden piles. Obviously this performance varies with the distance it is necessary to go to clear trains and other conditions peculiar to the individual job. Records for a 10-hour work day indicate that 8 to 10 piles represented a good day's work and that on some days not more than two or three piles can be driven. In estimating the cost of pile trestles, it is customary to consider five piles as a day's work of eight hours.

Owing to the fact that self-propelling drivers are available, every opportunity is taken to avoid the use of work train service, but under some circumstances this cannot be done. For instance, the drivers are not operated readily on their own power on grades much in excess of one per cent. On some of the longer spur tracks it has been found of advantage to cut in a short spur track on which the driver can be placed to clear trains.

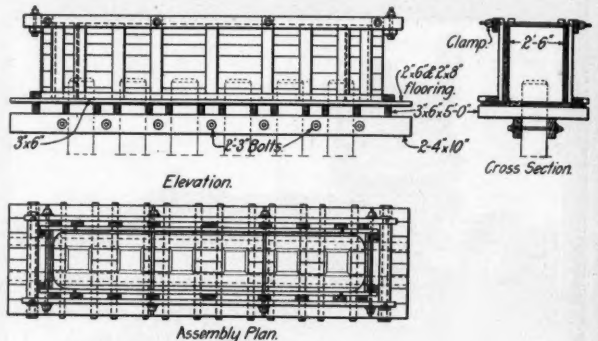
PILES ARE CAPPED BY A CONCRETING GANG

The pile driving is usually done by the master carpenter's regular pile driving crew, the work of which is completed when the last pile is driven to the required penetration or as far as they will go. The capping of the piles is done by a concreting gang, which also must cut off any of the piles that are found too high. The cutting is accomplished by breaking away the concrete at each corner of the pile until the $\frac{1}{2}$ -in. corner bar is exposed sufficiently to enable it to be cut off with a hack saw or a track chisel. Following this a groove is cut entirely around the pile, the longitudinal bars of the wire mesh reinforcement being cut off as they are encountered. This completed, the top of the pile is wedged off.

If the top of the pile is battered all the loose concrete is broken out, leaving the reinforcement exposed. There

is a tendency on the part of the men to bend this reinforcement down flat on top of the pile, but this is discouraged, as a much better bond with a cap is secured if the bars project up into the new concrete.

As the caps are of only two styles, namely, the single and double, the formwork is naturally adapted to unit-form construction for the sides and ends. The bottom, of course, is the chief problem owing to the variation in the positions of the piles which makes it necessary to cut up the bottom planks so that they will fit around the piles in their irregular positions, but the use of tin or other sheet metal to fill out the skew corners greatly decreases



Details of the Cap Form

the difficulty of this work. The entire form for the cap is supported on two heavy beams bolted to the piles on either side and usually the friction of these timbers against the piles is adequate to support the formwork and the caps. Occasionally this is supplemented by timber struts set up underneath.

The placing of the reinforcement follows the usual practice, although the cramped quarters under the existing bridge deck usually makes it of considerable advantage to assemble the straight bars in grids before attempting to place them in the form. As the end bents of the trestle are largely buried in the end of the embankment, very little formwork is required other than side forms on the side toward the bridge.

As the single bent cap contains only about five cubic yards of concrete, the concreting of the caps for a trestle of only three or four spans is a comparatively simple task. However, unless the work is unusually small, it is customary to bring a mixer on the job so that the concrete may be machine mixed. The method of arranging the concreting plant and of delivering the concrete to the forms depends on the size of the job. For the smaller structures a plank runway is laid on the ties for the delivery of the concrete in wheelbarrows. If the trestle is so long as to entail an appreciable haul, concrete cars with standard-gage trucks are operated on the track over the bridge, while on especially large jobs a narrow-gage track is built on brackets along one side of the existing trestle.

Just as the equipment and plant utilized is subject to variation with the size of the work, so the size and organization of the concrete gang is modified to fit the volume of concrete to be mixed and placed.

The standard slabs vary in weight from 14 tons for the 14-ft. slabs to 42 tons for the 25-ft. slabs. The equipment available for their erection consists of the division wrecking cranes with capacities ranging from 60 to 150 tons and four bridge erection derricks of 25 tons capacity. The manner of erecting depends upon the character of equipment available, the size of the slabs and the local conditions. Owing to the fact that the erecting equipment must frequently come long distances, the work

is usually arranged so that slabs may be unloaded from the cars at the same time that they are placed in the structure, thus avoiding two trips for the erecting equipment and the gang.

With the smaller slabs it is entirely safe and practicable for the derrick to pick up a slab from a point beyond the end of the bridge and carry it out onto the trestle and lower it into place in the gap previously cut in the deck of the existing structure. With the heavier slabs this cannot be done. Consequently, it is necessary to deliver the slab on a flat car directly over the point of its final location, lift the slab off the car onto temporary bents alongside the trestle and then, after the car has been released, to cut the track and existing deck and finally shift the slab into position.

The force for doing this work consists of the foreman of the wrecker and the engineer to operate it, together

with a bridge gang. Owing to the great variation in the interruption to this work with differences in the amount of traffic, the work accomplished by the erecting crew in a day is subject to wide variation. The average performance is eight slabs or four spans of single track per day.

The bearings of the slab on the bent are finished with a sheet of zinc 14 in. wide and about $\frac{3}{4}$ in. thick, laid on top of the caps and covered with a layer of stiff cement mortar $\frac{3}{4}$ in. thick. This mortar flattens out under the weight of the slab and takes up any irregularity, while the zinc sheet provides a break in the bond so as to afford an effective expansion joint.

We are indebted for the above information to G. A. Haggander and F. H. Cramer, bridge engineer and assistant bridge engineer, respectively, of the Chicago, Burlington & Quincy, Chicago, Ill.

Excessive Timber Decay on a Mexican Railroad

IN DECEMBER, 1918, J. D. Mathews, engineer maintenance of way of the Southern Pacific Railroad of Mexico, made a trip of inspection over the unoperated portions of that railroad lying south of the town of Acaponeta in the State of Hayarit, aggregating about 103 miles. The following interesting statement of the condition of the timber in those tracks, taken from the report of Mr. Mathews, was published in the Cross Tie Bulletin.

The operation of trains over this portion of the line was discontinued by the railroad company in 1913 on account of revolutionary disturbances. A continuance of operation was attempted by the military authorities until some time in 1913. Since that time the line has been idle with no attempt at operation.

This portion of the line was constructed from 1909 to 1912 and was completed into the City of Tepic at the close of December, 1911. The timbers in the track and trestles in 1918 were those used in the original construction and, therefore, had been in service from seven to nine and one-half years. Portions of this line saw but a few months of operation and none of it saw more than two years, except for a short period under the military authorities during the third year. The present condition of the timber, therefore, reflects principally the action of decay as deterioration under traffic or mechanical wear could not be considered as an important factor.

Pine timbers and generally the sapwood of all timbers decay very rapidly on the coastal plains of Mexico which border on the Gulf of California. This is particularly true in the region south of Culiacan, the capital of the State of Sinaloa. A rainfall of 30 to 40 in. per annum causes the soil to remain damp for a considerable portion of the year. This, combined with a warm, moist atmosphere and associated with a jungle growth of grasses, underbrush, and trees covered with a tangle of vines, produces a condition which results in a rapid destruction by decay of woods not resistant to fungus attack either by reason of their natural physical properties or after treatment with a preservative.

Untreated pine is particularly susceptible to decay in this region and more so when sawed into stringers, caps, ties and guard rails. Creosoted pine, used in bulkheads, has suffered but little in the nine years since construction. Untreated pine, however, has rotted in various structures until trestles are sagging from their own weight, although they have not carried any traffic for nearly five years. Thus, in the space of nine years and absolutely unin-

fluenced by traffic loads for the last five years, a number of these trestles have rotted to destruction.

Decay attacks the exposed end fibers most readily and traverses them longitudinally under a sunbaked shell of often respectable appearance. Ties that will crush under foot not infrequently present an almost perfect external appearance. Entering the ends of the sticks, the decay fungus penetrates caps and stringers, sometimes but a few inches but often for several feet, and in some cases the entire piece is affected. Points of contact are also locations of rapid decay. Stringers decayed at the ends and over the center caps are useless although the major portion of the stick may be sound. Decay of stringers over the caps produces decay in the caps if built of untreated pine. If constructed of redwood, however, the stringers and caps will be practically unaffected by decay.

End panels of trestles have suffered more than the centers but the centers have been far from immune. This is undoubtedly due to the fact that the end panels are in a more continuous state of dampness, resulting from a closer proximity to the heated earth. They are also more continually covered by the shadows of adjacent trees, while the center panels are frequently over the tops of the trees and face the rays of the sun.

Nevertheless, while the timber in the center panels of the higher trestles will undoubtedly give the longest period of service, yet in these lowlands the maximum length of life of untreated pine, under the best conditions, will probably not exceed ten years. By far the greater part will have disappeared in much less time. Such timber is seldom placed under more favorable operating conditions than as decking for steel bridges, many of which on this line are fifty feet or more above water surface. Few of these structures have been in place more than eight years and with this length of service under the best conditions a high percentage of the ties and guard rails are completely gone.

Pine cross ties have suffered most severely of all. Panel after panel of these ties is completely gone. This does not simply mean "have become unserviceable to the point of removal." They have gone until the rails, over which no traffic has passed in five years, are crushing them down. In many cases the ties have been completely disintegrated and the location of such ties is marked by a mass of shapeless rot.

The conclusion from the investigation is that untreated pine in these warm, moist coast lowlands will give but a few years of service. The pine cross ties ceased to be

in a condition for service an unknown period of time back, probably three or four years, for long before they reached their present condition they would have become unsuitable for operation. It is probable that three or four years under traffic would have been their average life. Likewise, trestle timbers for the most part have long since decayed beyond the point at which they would have been satisfactory for service. As with the pine cross ties we have to look backward for the point of time to which these trestles could have been operated in safety. Many of them passed this limit not less than two or three years ago and some of them even further back. It thus follows that six years seem to be the limit of life for much of this trestle timbering of pine, although a little of it may give a service of ten years.

On the other hand, cedar piling, redwood caps and posts and redwood cross ties stand out in bold contrast to pine timber in point of view of service in this region. For the most part, cedar piling is only now approaching the point when renewals must begin. Redwood ties, in a number of actual counts of ties in track after testing by picking and hammering with prospecting picks, developed only from five to ten per cent of more or less doubtful cases of renewals required. This was found under exactly the same conditions that caused such excessive decay in the pine timber. It thus follows that the use of redwood to displace pine for cross ties and trestle timbering in everything but stringers will be not an ultimate economy but an immediate one. Renewals will begin in all replacements in pine in two years and will be continuous until the last stick will have been removed inside of eight years. With redwood, the evidence indicates that we can depend upon a minimum service of eight years with the average and maximum service not yet determined. It appears safe to prophesy that the service of redwood ties in this region will be several years longer than the demonstrated minimum.

While this discussion is confined to the territory south of Acaponeta, practically the same conditions prevail on the operated line with apparently undiminished force up to the vicinity of the City of Culiacan.

CURING WATER POCKETS ON THE N. C. & ST. L.

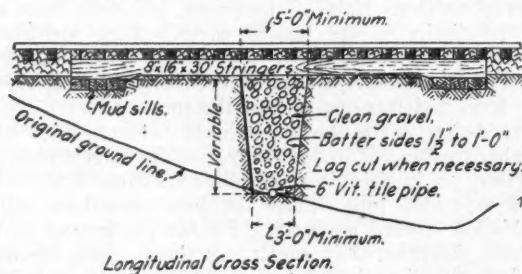
WATER pockets cause trouble on all railroads except those in arid or semi-arid regions. The greatest difficulty occurs, of course, on lines passing through a territory subject to heavy rainfall where the material in cuts and fills consists largely of soils or clays that hold water like a sponge and settle under traffic to form trough-like depressions in the roadbed. As this water cannot get away, it causes no end of troubles.

The only real solution for this condition is to cut off this water from the pockets, and the success of a method that has been tried out by the Nashville, Chattanooga & St. Louis, which encounters this difficulty in many places, shows that the best policy is to go directly to the seat of the trouble rather than to attempt any half-way measures.

In fills a trench is cut across the roadbed to as great a depth as possibility of drainage will permit, a six-inch vitrified pipe is laid with open joints in this and covered with clean gravel that fills the trench completely to the bottom of the ties. This mass of gravel intercepts the water that would otherwise go into the pocket in the roadbed, and leads it to the pipe. The trench is not cut through the pocket, but near the up-grade end of it, so as to cut off all water that flows down the grade.

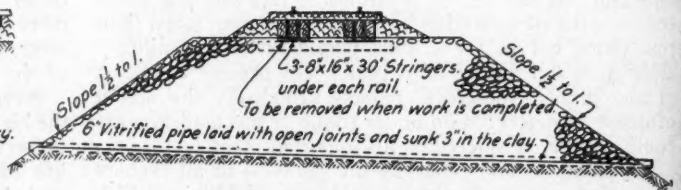
In the case of cuts, the trench can be no deeper than the side ditches or drains laid under the ditches, but for fills the trench can be carried to the full depth of the embankment. In the fills the minimum bottom and top widths of the trench are three feet and five feet, respectively, thus requiring the use of falsework to carry the track while the drain is being constructed. In cuts the drain is placed at an angle with the track to give it a pitch in the direction of the grade.

This method is not used in all cases, but is applied wherever the conditions indicate its practicability. The spacing of drains is determined in each case by local conditions. We are indebted for above information to R. P. Trabue, general roadmaster of the Nashville, Chattanooga & St. Louis Railway, Nashville, Tenn., who originated and recommended the use of this method.

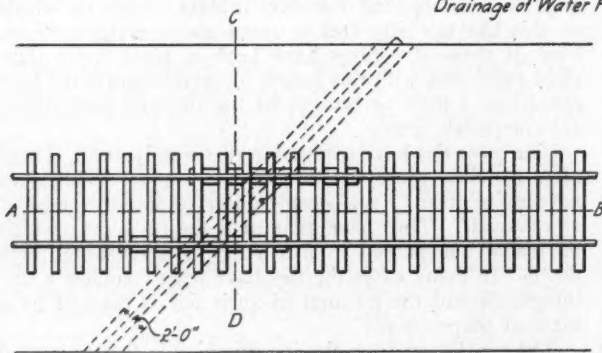


Longitudinal Cross Section.

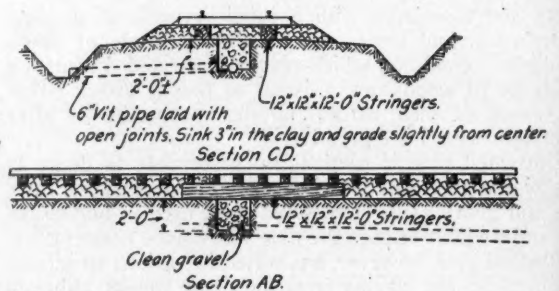
Drainage of Water Pockets in Fills.



Transverse Cross Section.



Drainage of Water Pockets in Cuts.



How the Gravel-Filled Trenches Are Introduced

WHAT OFFICE FORCE SHOULD A SUPERVISOR HAVE?

Six Practical Men Discuss the Organization Necessary to Give the Most Efficient Results

THE AVERAGE supervisor has an aversion for office work. He feels that his place is out on the line where his men are at work and the money is being spent. Furthermore, he has ordinarily served his apprenticeship in the field and he has a dislike for office work and its details.

In spite of this prevalent dislike for office work, the supervisor of today recognizes the necessity for records and reports. With the increasingly strict regulation of the railways by governmental agencies the need for these reports is increasing rather than decreasing. Furthermore, the progressive supervisor can himself gain much valuable information from these reports, which information he can utilize in the efficient conduct of the operations under his control. He can therefore well afford to give personal attention to the organization of his office force in order that he may secure from this organization not only the clerical assistance necessary to enable him to spend as much time as possible out on the line, but also the records which his superior officers need and those which he can himself utilize.

Because of the importance of this phase of a supervisor's organization we present below six discussions of this subject which have been prepared by supervisors who are themselves in charge of maintenance of way work and who discuss this problem from their viewpoints.

MAKE THE OFFICE ORGANIZATION AN ASSET

By J. P. COSTELLO

Roadmaster, Atchison, Topeka & Santa Fe, Pueblo, Col

IT IS TRUE that nearly every supervisor feels an aversion for clerical and accounting work for at least two reasons: First, he is more interested in the accomplishment of a piece of work than in the paper record of its accomplishment, and second, due to insufficient office help and equipment to do the things required, combined with the fact that continuous personal supervision of the office is impossible, the office work is never perfect, and this causes a loss of personal interest. Most supervisors could spend every day in the office to keep the records, reports and correspondence as they should be kept, but this could only be done to the neglect of the essential things for whose care they are paid. On the other hand, there is a certain amount of administrative work which can and must be handled in the office. The expenditures for labor consumed and materials used must be recorded and classified with reasonable promptness in order to avoid excesses in the work already under way and to serve as a guide for expenditures in future operations.

However, when I hear arguments and discussions setting forth the importance of office work and accounting, I am frequently reminded of the finding of the footprints on the sand by Robinson Crusoe—a very important thing, indeed, to Crusoe, but important only for the reason that they recorded the activities of a man—the man and his activities being the essential things.

Another illustration occurs to me: The farming journals frequently comment on the necessity of keeping proper farm accounts and point out that the poor farmer is usually the one who keeps no accounts. It is conceded that the bookkeeping is important, but if a farmer must neglect one of the two things, corn-planting or bookkeep-



Office and Force of A. M. Clough, Supervisor, N. Y. C., Batavia, N. Y.

ing, it is obvious which one he must choose. When corn must be planted and accounts should at the same time be kept, he should have, if possible, sufficient help to do both. Likewise with the supervisor, if his outside work is essential and his office work is necessary, his office force should be sufficient to handle all the office work required of him.

At conventions we have frequently heard addresses by men prominent in railroad work and one of their favorite expressions is this: "The roadmaster's place is out on the road—not in the office and his work should be handled by personal contact with the foreman rather than by correspondence." Did you ever notice that this advice comes mostly from men who have never been roadmasters?

The advice is good only to a certain extent. Many things can be handled with greater expedition and accuracy by correspondence than by word of mouth, especially if a roadmaster must travel a hundred miles to get his mouth on the job. The marathon runner was a very picturesque figure, but would not be practical in these days of swift communication by other means.

The writer has long been an advocate of intensive supervision, but believes that even intensive supervision by personal contact can be overdone. The roadmaster who wishes to be present whenever a frog or a pair of switch points is to be changed or a trainmaster who attempts to be on the scene to replace every pair of derailed wheels will soon find himself in a position where he will be compelled to be present on such occasions. I heard a veteran railroad superintendent remark recently in commenting upon the system of supervision of another road that their management was insisting on intensive personal supervision to the extent that the initiative of the men was being killed.

Every district roadmaster having 15 or more foremen under his charge should have a clerk of his own and to whom he can look for perfect loyalty and support. While the writer is averse to overdoing the personal contact feature, he feels sure that there is little danger of too much intelligent direction of track forces and it is in this connection that the roadmaster's clerk can be of invaluable assistance. It is believed by many accountants that each division should have a traveling material man and time-keeper. Isn't this just what the roadmaster's clerk was originally intended for? Do they do this class of work? No, and for this reason: Whenever it is possible to consolidate two roadmasters in one office and merge the clerical work under one clerk, it is done. Frequently, also, this clerk may be called upon to do work for the super-

visor of bridges and buildings, or for the signal supervisor, or for the division accountant. Question: To whom does this clerk owe loyalty?

Let the work of the roadmaster's office be so standardized that it may be handled properly by the clerk and let proper allowance be made for the time necessary to do the things which the roadmaster himself wishes to have done, such as the keeping of work progress records, personal records, records of discipline and irregularities, etc., and let some allowance be made also for a trip, say once a week, out on the road to help out some weak foreman, or to look up some material and then the clerk will be able not only to keep the records in better shape, but will be aiding the roadmaster to better supervision. Without entering into the ethics of the present movement as regards the reduction of wages of the section forces, it is perfectly safe to say that their wages will never again be so low that lax supervision will be tolerable. A simple aid to better supervision is that which could be rendered by a good clerk as above stated.

Some time ago the writer was in an office occupied by two roadmasters. Both of these men were at their desks and they advised that it was customary for them to work till 10 o'clock every night when not on the road. Asked if each had a clerk, one replied: "No, the two of us have half a clerk." Just then the clerk, a one-legged man, came in, and, judging from his grizzled appearance, he must have lost his other leg at the Battle of Monterey. Cases similar to this are not uncommon and it should be remembered that while the time which a man may be able to give to a job is *variable*, the energy which he is able to deliver is a nearly *constant factor*.

The impossible should not be expected of the foremen. Considering the source of a great deal of the records of the maintenance of way forces, the refinements of accounting frequently insisted upon are about as consistent as the application of the theory of "Least Squares" in the office computations of a survey made with a cloth tape. Some time ago when I took a foreman to task for his shortcomings as to reports and other things and advised him to use his head a little more, he replied: "If I had as much brains as Charley Schwab I wouldn't be a section foreman." So it goes. If our foremen were as good all around men as we think they should be, they would not be working for us.

What can be done to improve the office work without impairing the outside supervision? Let each roadmaster have his own clerk and let the work be so standardized (or even limited) that it can be properly accomplished and do not allow this standard to be changed arbitrarily at will by "someone from the inside office." Make allowance for occasional trips on the road by the clerk. Give the roadmaster credit for being desirous of keeping the office work in proper shape when it can be accomplished without sacrificing the all-important outside supervision. Let it be understood that there are some things in the clerical line which the roadmaster himself wishes to have done, and that there are many instructions put out by him for which he wishes to have tangible record. Remember, too, that there are many irregularities which he wishes to correct without advertising the fact to the whole division and I contend that in this respect in his own sphere he has as good a right as the general manager in his.

Simplify the foreman's reports. I mean actually, not in theory. This has been talked of for years, but each year adds new reports to the foreman's list. Let those who are in a position to criticize the foremen do so for constructive reasons and not simply because the foreman's weakness causes them some personal inconvenience.

Let the foreman make a daily report of time and material in such a way that his books are closed each night. This system will require and secure daily attention to these things and is very desirable. Insist on accurate time returns and reports of materials used and above all forget about checking, footing, cross-footing, adding, subtracting, multiplying and dividing on the part of the foremen.

ON A BUSY LINE

By CHARLES J. LEPPERD

Supervisor, Philadelphia & Reading, Pottstown, Pa.

THE OFFICE organization needed by a supervisor will depend upon the mileage of tracks under his supervision and the accounting methods in use on that particular railroad. The outline which follows covers the organization of an office of a supervisor's sub-division of a normally busy three and four track road, consisting of 180 miles of main tracks and 95 miles of side tracks. Included under this supervision are the carpenter and mason forces, the foreman carpenter having one clerk.

In addition to correspondence which usually keeps one stenographer busy, the office handles requisitions and bills for material, keeps stock records of the same and does all I. C. C. primary accounting of maintenance of way expenses. The amount of office work that should be done by a supervisor and his assistant is a debatable question upon which there may be endless argument. The successful handling of an office on this railroad requires personal attention from the supervisor and a minor proportion of his time. He needs to check and control foremen's requisitions for all material except small supplies or tools, and to check closely all requisitions signed by himself. Correspondence involving instructions to work-train conductors and foremen ought to be handled by the supervisor, or in his absence by the assistant. There is also a large amount of technical correspondence which may be handled intelligently only by him.

In order to have material and stock accounts handled by one who is familiar with such material this should be done by the assistant and with such clerical assistance as he can use probably will require one-fourth of his time each month. Another large proportion of his time is spent in making sketches, plans and estimates for proposed work. The late I. C. C. Valuation Order No. 3, covering extensions and improvements, involves a large amount of technical estimates and accounts in connection with such work and our plan is to have the assistant handle it with the assistance of the timekeeper.

The remainder of the office work requires three clerks—a chief clerk, stenographer and timekeeper. The chief clerk, who probably should be a promoted stenographer, is in charge of the office, handling routine correspondence, requisitions for small supplies, such as stationery, oils and tools. The work of filing and indexing completed office files requires a large amount of time and the chief clerk should be held responsible for this and do the work himself with any assistance the stenographer may be able to give him. Permanent office records should be available at all times and there should be at least one clerk entirely familiar with the system and the files to be able to find them on short notice. This is the principal reason why a chief clerk should be promoted from the stenographer's position, because, as such, he has had the opportunity to familiarize himself with all duties connected with the office.

The stenographer, in addition to the usual duties as such, should handle the open or working office files and may handle a large amount of routine correspondence upon his own initiative. Much time may be saved for

the supervisor if correspondence such as replies from foremen to circular letters is tabulated by the stenographer so that a glance at one tabulation will enable him to secure the desired information.

With the increasing detailed accounting required of all railroads the once simple work of timekeeping is becoming more and more complex and requires at least one timekeeper for winter force and perhaps an additional one during summer, if the extra force allowed is sufficient to make this necessary. Foremen report on a daily time sheet, names of men working, hours worked, and a short description of the nature of work done, as well as its exact location. A semi-monthly pay and time roll is then made for each gang. On the same time sheet there is made a distribution of all wages into I. C. C. primary accounts. While indices to these accounts are provided, a timekeeper must be thoroughly familiar with the system to avoid wasting his time hunting through the index book. At the end of each pay period the timekeeper will need the assistance of the remainder of the office force for one or two days, as the pay rolls must be forwarded on the day following the end of the pay period.

There was a time when the supervisor's office force hoped for a reduction in the number of daily, weekly, monthly and annual reports, but it is apparent now that with the increased accounting required of all railroads, there is little hope for a reduction in the necessary clerical work. The tendency is to do primary accounting as near the actual work as possible, and as it is impossible to have it done by section foremen, no doubt this accounting will continue to be required of the supervisor's office. If so, the above outline of help required is a minimum for an efficient force and may have to be increased for additional or special work, or on account of increased accounting.

A BRIDGE AND BUILDING SUPERVISOR'S OFFICE

By E. M. GRIME

Supervisor, Bridges and Buildings, Northern Pacific, Fargo, N. D.

THE AMOUNT of work in a supervisor's office depends to a large extent upon the general arrangement of the railroad organization of which his department is a section. In those organizations where there is a division engineer as the head of the maintenance department on each operating division that officer usually keeps many of the records, handles the pay rolls and does much of the accounting in his office, but where there is only a district engineer covering several divisions, a supervisor's office may be required to keep all the records and accounts of all ordinary maintenance and construction work in the line of bridges, buildings and water supply.

With the latter condition in mind, in order to secure the best results, it is very desirable for the supervisor to keep a first-class correspondence file which will contain a complete record of every transaction with which his department has any connection. He should also keep a clear record of the material used and the labor involved in every item of Addition and Betterment work with a clear division as between capital and operating accounts, and also keep a record of each repair item which is undertaken, not only to know just what material and labor enter into the same as well as the unit costs of the different classes of work, but also to have a record of the expense for maintenance of each type of structure so as to be prepared to recommend the most economical types for future construction. He will naturally be particularly interested in keeping an accurate

record of all bridge and culvert repairs, renewals in kind, or replacement by permanent structure, and endeavor to have a complete history of every such structure on his territory so as to be in position to furnish the bridge engineer all information required when a new bridge or culvert is contemplated at any point.

When there is no separate water service organization the details of that department usually devolve on the supervisor's office and it is desirable to have a complete record of the performance at each water station so as to know the amount of water pumped, the repairs and renewals required, the supplies used and the labor involved, thereby securing the unit cost per thousand gallons. This will enable him to note the most efficient plant and discover the most economical type of pumping machinery for the service required. Where water is purchased from a municipality a record will be kept of the meter readings so that any unusual variation in consumption may be the means of discovering an unsuspected leak. At water treating plants additional records are necessary, covering the chemical analysis of the water at frequent intervals in order to know that proper operating results are being secured.

During the past few years there has been a constant tendency to increase the amount of detail accounting required for all classes of work. This was due largely, at first, to the advent of Government control of the railroads, and now most of it has become a necessity by reason of the operation of the Transportation Act, which makes extremely desirable a clear division and accurate listing of operating and capital accounts.

Another large increase in the supervisor's office details is due to the adoption of working agreements with the maintenance of way forces. Such matters as seniority, schedules, meetings with grievance committees, hitherto unheard of in this department, now require no little time both of the supervisor and his office force.

The above is a very brief summary of the numerous details devolving on the supervisor's office. Efficiency requires that the supervisor shall not be tied down to office details, but that he shall have the opportunity to give his time largely to supervision so as to keep in close touch with all the work in hand and also be in more or less close personal contact with all his men. It is therefore desirable for the best results that the supervisor's office force in most cases consist of one first-class clerk, who is also a stenographer, and who understands the nature of bridge and building work and is capable of keeping up the records required, making requisitions for material, and at the same time keeping up the general office work as well as properly handling small schedule matters such as overtime, seniority and working conditions. This clerk should be a person of marked ability along these lines and under most conditions will require the assistance of a good stenographer. In very slack times like the present the stenographer may be dispensed with temporarily, but if the clerk is not retained it either becomes necessary for the supervisor to handle his own office work to the detriment of outside work, or else let the records deteriorate to a degree which, to say the least, is very discouraging to one who desires to handle his work to the best interests of the company he serves.

The supervisor must necessarily have a large capacity for details because his work involves not only many engineering problems, but also a knowledge of numerous trades. For real efficiency he should have an office force capable of relieving him of all the minor details so that he may have some opportunity to give thought to the general situation and carefully plan all his work to the best advantage.

ONE CLERK FOR TWO SUPERVISORS

By J. MORGAN

Supervisor, Central of Georgia, Goodwater, Ala.

ORDINARILY a supervisor shares the aversion for office or accounting work and generally considers it second to his other duties as a maintenance officer. As a result the accounting does not get the real attention that it should for the simple reason that a supervisor, to attend to his duties properly, should be out among his men daily, especially since he is compelled to hold expenses down to the minimum and yet maintain a safe track.

On our road we could place two district supervisors' headquarters together and put on a good roadway clerk to take care of the office work of the two supervisors, this clerk's duties being to take care of the daily communications, accounting, etc., that ordinarily take up so much of the time of the supervisors which could otherwise be spent to much better advantage out among their men on the track. One or two entire days each month spent by the supervisor with the foreman of each gang on his district in discussing the short cuts, and advantages in doing work a certain way, will materially advance our work and build each gang up to higher efficiency more quickly than any other way.

As our organization stands at this time, a supervisor has about 12 to 15 gangs under his charge, covering about 80 to 100 miles of single track main line with additional mileages of branch line in most cases. Coal chutes and water stations are also under his charge. We have no assistance at all in the office, yet we are required to do quite a lot of accounting, some of which require considerable time and thought to handle. We make daily, weekly, semi-monthly and monthly reports, including two days' actual time required at the end of each month accounting for materials received, used and on hand, by sections, then a recap of it, all of which must necessarily be made correctly. One clerk could handle the accounting and clerical work for two supervisors if their headquarters or offices were at one place, as above suggested.

SUPERVISOR REQUIRES ONE GOOD CLERK

By S. C. TANNER

Superintendent of Maintenance of Way Shop, Baltimore & Ohio, Martinsburg, W. Va.

THE PROPER office organization for supervisory forces is a subject that must be governed largely by the character and volume of business handled and number of employees engaged. In all branches of employment where supervising officers are required, office records and accounting are of the utmost importance to the supervisor and the business involved compares favorably with the merchant who buys or sells his products.

A supervisor should know the cost of performing any given piece of work, with labor and material separately, so that he can report it intelligently and make estimates correctly. He should know at all times the amount of materials of various kinds which he may have in stock, when received and where located. He should keep sufficient records on file to enable him to make a correct report on any business performed in previous years, with sufficient data to explain the transactions satisfactorily in detail. He should keep a close record of all cars or equipment handled and must be prepared at all times to furnish proper information for Interstate Commerce reports, etc., of which there are many. If the supervisor is capable of performing the duties of a clerical position

and endeavors to do them he will neglect the work of supervision and his forces will suffer accordingly, resulting in inefficiency on his part and a decrease in output by his forces.

Believing that the above statement as outlined is the true situation with practically all supervising officers, the important question is, how much office force is required? It is safe to say that the office force should consist of enough clerks to properly handle the business involved in the prescribed number of hours they are to work. The supervisor should be capable and in a position at all times to supervise his office force and see to it that long and superfluous correspondence is eliminated and only such work as is actually necessary is performed and that such forces are required to do a full day's work for a full day's pay, the same as any other forces under his supervision. The office force necessary for a supervisor of bridges and buildings or a supervisor of track should consist of one good clerk, one who is capable of taking dictation in shorthand and operating a typewriter. He should also be capable of keeping records, accounting and files, computing stocks of materials and applying up to date prices on same, checking and recording purchase or storekeeper's invoices, car records, inspections reports, checking time sheets, etc. He should be a good all around clerk, capable and full of energy.

THE ORGANIZATION FOR AN EASTERN SUPERVISOR'S OFFICE

By A. M. CLOUGH

Supervisor, New York Central, Batavia, N. Y.

THE ROUTINE of my office is, that the first assistant is on the road with section gangs, extra gangs and work trains all of his time. There is also a second assistant, whose duty it is to handle all the surveys of new work, right of way lines and levels. He has a complete engineering and drafting outfit, handles ballast profiles, rail charts, etc., and spends all of his time not employed in engineering work, with the gangs on the road.

The chief clerk handles all accounting, pay rolls, requisitions and bills for material received and shipped away, and is assisted by the stenographer and timekeeper. We make all reports to the division engineer, but handle all the accounts of every description as a unit apart from any of the other subdivisions under the division engineer.

You have heard the story about the section foreman who had but one man and found a broken rail. The book of rules said to "flag both ways." He read it twice. Then he said: "Jerry, yeeze take one of the rid flags and go south twenty-wan poles and I'll take the other wan and go north and we'll let the dom book o' rules stay here and slap in the rail."

* * *

A foreman and his man Friday found a broken rail one cold morning. It was near a farmer's house, so they asked the farmer to help them put in a new rail. It took about an hour and the section foreman turned in one hour's time (15 cents) for Bill Jones.

The road had a mutually collected hospital fund at that time, under which they deducted 25 cents per month for each employee. The clerk in charge of this bureau made the regular deduction and put the "two bits" in line for collection.

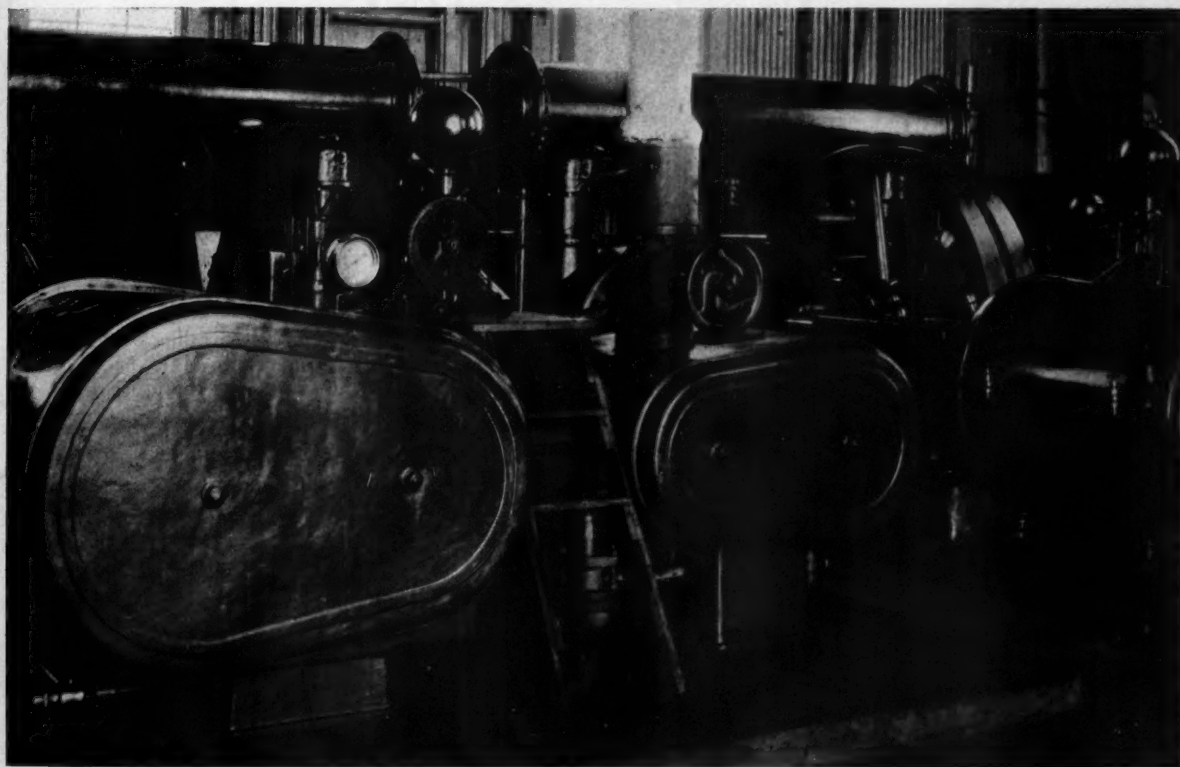
"I see by the papers that Bill Jones owes us tin cints on the hospittle fund. Shall I go over and collect it or shall I let him work it out some time?" W. H. F.

SOUTHERN PACIFIC IMPROVES WATER FACILITIES

Intensive Campaign Eliminates Severe Shortage of Supply and Long Haul in Desert

THE TUCSON division of the Southern Pacific includes 564 miles of main line track, all in the desert. When the line was built in 1879 and 1880 the urgent need of hurrying construction through to get a connection from the Pacific to the Atlantic, and the common belief of the men in charge of the construction that there was no water to be had in the desert, resulted in the development of water supplies through the section that

inaugurated a campaign to install water stations on the Tucson division, located an average of 25 miles apart. Failure was predicted, but the work was undertaken and a beginning made at Yuma, the west end of the division. For years at this point the road had pumped water out of the Colorado river into large concrete settling basins, in which it was confined 12 hours to permit settlement of the mud prior to its use in the boilers. Here was pres-



Interior View of Pumping Station at Bowie, Ariz., Showing Air Compressors

were inadequate, even at that time. However, these supplies, with but little improvement, remained the only source of water until 1917. During the latter part of 1916, the tonnage on the Pacific coast and in the Imperial Valley in California experienced a very large increase and it became especially urgent to find relief from the conditions imposed by the water supplies as there were times when traffic was delayed and blockades caused by it. Everything possible was done to overcome the unfavorable conditions, such as hauling water cars which weighed 50 tons and each of which, of course, took the place of a car of revenue freight for a distance of 400 miles. For this purpose oil cars were converted into water cars, an expensive practice. There was also always a great demand for oil cars and each oil car converted for water service correspondingly decreased the oil car supply.

In 1916 W. R. Scott, then general manager of the Pacific System and now president of the Atlantic System,

ent another troublesome feature in the frequent breaking of machinery, there being but the one pumping unit. Furthermore, freight traffic regularly experienced delays incident to the precedence given passenger movement, there being five passenger trains in each direction over the division, all of which carried water cars and which in themselves often encountered conditions at Yuma where it became necessary to fill the engine-tender with a hose from the small city water mains.

Two wells were drilled to a depth of 246 ft. and 252 ft., respectively, and a good quantity of water secured. Two Layne and Bowler turbine pumps were installed, operated by electricity, and since that time the road has never known what it is to be troubled with a lack of water or to have any delay at that station on account of the water supply. The quality of the water is not of the best, but it is serviceable. This water contains lime carbonates in sufficient quantities to cause a considerable deposit of scale in boilers and the non-incrusting solids con-

tain sufficient alkali salts to cause foaming in the boiler when carrying a heavy load.

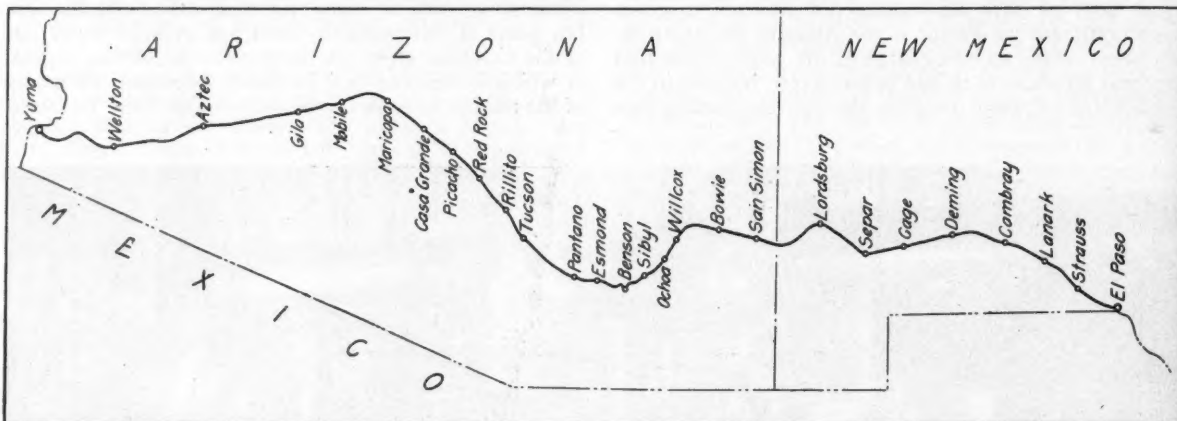
WORST WATER AT WELLTON

The next water station constructed under this program was at Wellton, Ariz., 37 miles east of Yuma. In many instances when other wells were pumped dry, or rendered inoperative by machinery failures, Wellton provided the water for one freight district, 123 miles, from Yuma to Gila. It was formerly necessary to maintain three pump-

route. Here two wells were sunk to a depth of 710 ft. and two Layne and Bowler pumps, driven by two 25 hp. gas engines were installed and a 350,000-gal. steel tank erected. Since this installation has been completed no further trouble has been experienced on the freight district from Yuma to Gila.

WELLS 1,746 FT. DEEP AT GILA

During heavy business the supply of water at Gila, Ariz., where there were two wells, would become exhausted,



Map Showing Location of Water Stations on the Main Line of the Southern Pacific, Tucson Division

ers at this point, but since installing two units (two Layne and Bowler pumps belt driven by two gas engines) the services of only one pumper are required to maintain the supply of water, a saving of \$3,176.16 per year thus having been made in pumpers' salaries. The water at this station, however, is the poorest quality on the division, containing 26.59 grains per gal. of incrusting mat-

ter, which many times necessitated the hauling of water from Wellton, 85 miles west, and from Maricopa, 42 miles east, to supply this terminal. It was therefore decided to go deeper and at a depth of 1,746 ft. an inexhaustible supply of water was found. Two Ingersoll-Rand Imperial air compressors were installed and the water is forced from the wells into the tank by compressed air. After the

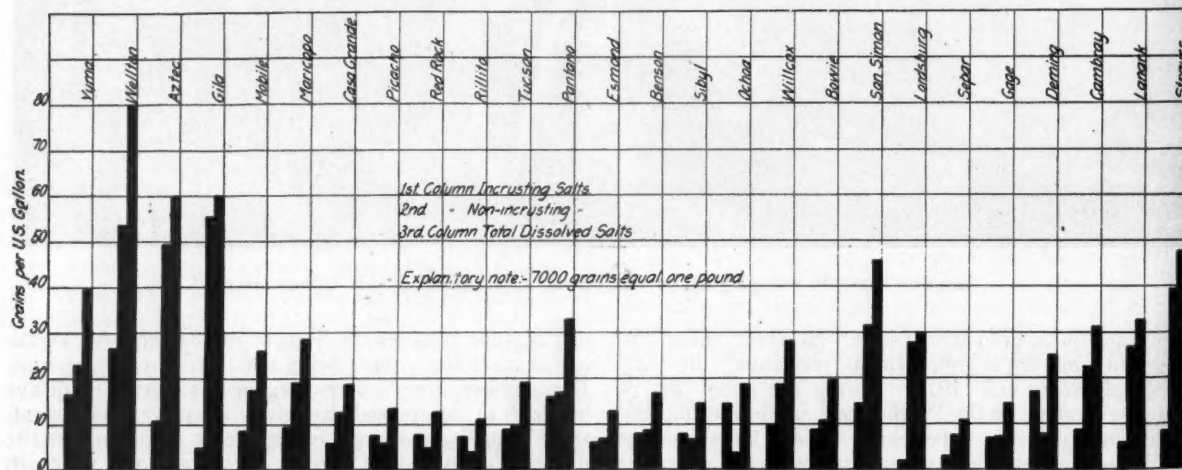


Chart Showing Condition of Water Supplies on the Tucson Division of the Southern Pacific

ter and 53.42 grains per gal. of non-incrusting matter, or a total of 80.01 grains per gal. of solid matter.

Fifty miles east of Wellton there was a water station at Sentinel. In periods of heavy business many full tonnage freight trains, after using their engine tender of water and a full car of water which they had taken at Wellton, ran out of water before reaching this station. The result was serious. To overcome this adverse operating condition it was necessary to prospect for water at Aztec, which is one of the most desolate spots on this

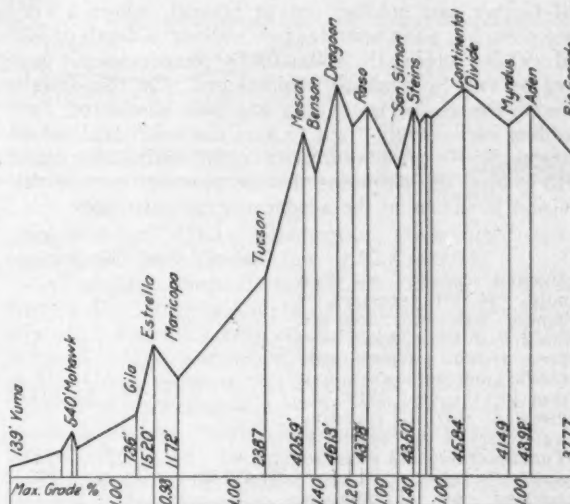
installation of this plant no further trouble has been experienced. The temperature of the water from these wells registers 110 deg. Fahrenheit as it comes out of the ground and in extreme hot weather considerable difficulty is experienced in getting locomotive injectors to pick it up on this account. Similar trouble is also encountered at Sentinel, where the temperature of the water in the wells is about the same. At Gila it has been necessary to install a device to cool the water before it is used.

The next water station eastward was located at Mari-

ANALYSES OF WATERS ON MAIN LINE, TUCSON DIVISION OF SOUTHERN PACIFIC—GRAINS PER U. S. GALLON.

| Matter in Solution | Yuma | Wellton | Aztec | Gila | Mobile | Maricopa | Casa Grande | Picacho | Red Rock | Billito | Tucson | Pantano | Ramond | Benson | Sibyl | Ochoa | Willcox | Bowie | San Simon | Lordsburg | Sepul | Gage | Deming | Cambray | Lamar | Stras |
|---------------------------|------|---------|-------|-------|--------|----------|-------------|---------|----------|---------|--------|---------|--------|--------|-------|-------|---------|-------|-----------|-----------|-------|------|--------|---------|-------|-------|
| Lime—Carbonate | 10.3 | 9.7 | 2.1 | ..... | ..... | 5.9 | 3.4 | 5.3 | 4.6 | 4.1 | 5.6 | 11.8 | 3.7 | 4.7 | ..... | 8.3 | 5.2 | 4.1 | 9.2 | 0.3 | 1.2 | 4.4 | 10.5 | 3.6 | 2.1 | 3.2 |
| Sulphate | None | 4.4 | 0.3 | ..... | ..... | None | None | None | None | None | 0.3 | 0.7 | None | None | ..... | None | None | 1.11 | None | None | None | None | 0.9 | None | None | None |
| Chloride | None | None | None | ..... | ..... | None | None | None | None | None | None | None | None | None | ..... | None | None | None | None | None | None | None | None | None | None | None |
| Magnesia—Carbonate | 4.9 | 1.0 | 1.7 | ..... | ..... | 1.5 | 0.9 | 0.9 | 1.3 | 1.0 | 0.9 | 1.5 | 0.6 | 1.3 | ..... | 4.1 | 1.0 | 0.3 | 2.3 | 0.1 | 0.3 | 0.9 | 0.6 | 1.5 | 2.1 | 1.4 |
| Sulphate | None | 5.6 | None | ..... | ..... | None | None | None | None | None | 0.4 | 0.5 | None | None | ..... | None | None | None | None | None | None | None | 2.6 | None | None | None |
| Chloride | None | 3.5 | None | ..... | ..... | None | None | None | None | None | None | None | None | None | ..... | None | None | None | None | None | None | None | None | None | None | None |
| Silica, Iron and Alumina | 1.4 | 2.4 | 6.8 | ..... | ..... | 1.9 | 1.6 | 1.5 | 1.9 | 2.2 | 1.8 | 1.5 | 1.7 | 2.0 | ..... | 2.3 | 3.6 | 3.2 | 2.8 | 1.6 | 1.6 | 1.8 | 2.5 | 3.6 | 1.8 | 3.6 |
| Total Inerting Matter | 16.6 | 26.6 | 10.9 | 4.8 | 8.5 | 9.3 | 5.9 | 7.7 | 7.8 | 7.3 | 8.9 | 16.0 | 6.0 | 8.0 | 8.0 | 14.6 | 9.7 | 8.8 | 14.2 | 2.0 | 3.1 | 7.0 | 17.1 | 8.6 | 6.0 | 8.2 |
| Alkali—Carbonate | 11.6 | None | None | ..... | ..... | 1.5 | 2.0 | 1.7 | 2.2 | 1.4 | None | None | 5.1 | 5.1 | ..... | 1.7 | 11.5 | None | 2.7 | 16.3 | 5.4 | 0.6 | None | 7.8 | 8.4 | 14.0 |
| Sulphate | 2.9 | None | 15.5 | ..... | ..... | 11.2 | 7.2 | 2.2 | 1.4 | 0.9 | 7.8 | 13.3 | 0.7 | 0.7 | ..... | 0.8 | 2.8 | 5.6 | 20.4 | 8.0 | 0.5 | 5.2 | 1.2 | 7.3 | 8.9 | 16.6 |
| Chloride | 8.3 | 33.4 | 33.7 | ..... | ..... | 6.4 | 3.5 | 1.8 | 1.2 | 1.5 | 2.2 | 3.6 | 0.9 | 2.8 | ..... | 1.2 | 4.0 | 6.3 | 8.4 | 3.4 | 1.5 | 1.5 | 6.7 | 7.4 | 9.4 | 8.9 |
| Total Non-Inerting Matter | 22.8 | 53.4 | 49.2 | 55.3 | 17.5 | 19.0 | 12.7 | 5.7 | 4.8 | 3.8 | 10.0 | 16.9 | 6.7 | 8.6 | 6.6 | 3.7 | 18.3 | 10.8 | 31.4 | 27.7 | 7.4 | 7.3 | 7.9 | 22.5 | 26.7 | 39.5 |
| Total Dissolved Solids | 39.4 | 80.0 | 60.0 | 60.1 | 26.0 | 28.3 | 18.6 | 13.4 | 12.6 | 11.1 | 19.0 | 32.9 | 12.8 | 16.6 | 14.6 | 18.4 | 28.0 | 19.6 | 45.7 | 29.5 | 10.6 | 14.3 | 25.0 | 31.1 | 32.6 | 47.7 |

copa, 42 miles from Gila, 22 miles of this distance being up a 1½ per cent grade, where it was necessary to haul water cars on engines in both directions. In order to overcome this difficulty the road prospected and found water at Mobile, about half-way between Gila and Maricopa. Here one well was sunk to a depth of 451 ft. and a good supply of water of a fair quality was found. One



Condensed Profile of Main Line of Southern Pacific on the Tucson Division

double acting, belt-driven Luitwieler deep well pump, driven by a 30-hp. gas engine, was installed, which has satisfactorily solved the difficulties in this territory.

Many of the wells at the water stations between Maricopa and Benson, a distance of 136 miles, were not deep enough and in periods of heavy business the supplies would be exhausted. The wells were therefore drilled deeper and sufficient water of a better quality was found. At most of these stations two units were installed in order to protect against machinery failures. Large steel tanks were also erected at many of the stations, permitting the storage of a considerable quantity of water for emergency use.

There was also a bad water condition in Eastern Arizona, between Benson and Willcox, a distance of 42 miles, 22 miles of which was up a 1½ per cent grade, where it was necessary to use water cars. In order to overcome this condition a good supply of water was found at Sibyl at a depth of 1,000 ft. The water is raised by compressed air, supplied by an Ingersoll-Rand Imperial Type 10 air compressor which is operated by one.75-hp. oil engine.

At Bowie, Ariz., which is located in a belt where some artesian water has been developed, the existing wells would not supply sufficient water for heavy business. This was overcome by digging deeper and striking a better flow. Two units were installed instead of one. The three wells at this point are 495, 505 and 768 ft. deep, respectively. Two Knowles deep well pumps operated by two 80-hp. Penn. boilers constitute the pumping machinery.

Another bad condition existed between San Simon, Ariz., and Lordsburg, N. M., a distance of 34 miles, 22 miles of which distance is up a 1½ per cent grade. During heavy traffic trouble was experienced in making this run. At a point midway between these stations a new well is being dug through solid rock and it is expected that water will be encountered at a depth of about 1,500 ft.

The freight division of 147 miles from Lordsburg, N. M., to El Paso, Tex., is all through desert. Considerable money has been spent in undertaking to develop water at different stations along this line, and at one time the hope of obtaining water was given up, but in 1917 and 1918 further prospecting was done and a well located at Akela, 81 miles east of Lordsburg. Farther east another water station was developed at Afton, N. M., and still farther east another one at Strauss, where a very good pumping plant operates two wells at a depth of 975 and 950 ft., forcing the water up by compressed air supplied by two Sullivan air compressors. On this freight division the use of water cars has been eliminated, thus enabling each freight train to haul one additional car of revenue freight. The estimated annual saving effected in 1918 by thus discontinuing the use of water cars on this division is shown in the accompanying statement.

| | Labor | Fuel Oil | Total Saving |
|---|------------|------------|--------------|
| Estimated number of train miles (34,349) necessary to handle water car tonnage multiplied by average cost per freight train mile (\$2.705) on the Tucson division for the year 1918..... | | | \$92,914.05 |
| Estimated cost of repairing water cars—1 car repairer at Yuma working 313 days per year | \$1,452.32 | | 1,452.32 |
| Estimated cost of pumping Saving in labor of 5 pumpers and in fuel and supplies.... | 6,300.00 | \$6,000.00 | 12,300.00 |
| Estimated cost of handling and filling cars in yard: Yard crews at Yuma 6 hr. per day | 9,121.35 | 9,395.10 | 18,516.45 |
| Estimated delays to trains for water cars: Average total delay of 3 hr. daily to trains at Yuma for water cars.... | 3,978.50 | 7,044.50 | 11,023.00 |
| Interest on investment in water cars released for commercial service: Thirty 12-600-gal. water cars with an average book value of \$2,000 each, and eight 6,500-gal. water cars with an average book value of \$800; or 6 per cent interest on an investment of \$64,800..... | | | 3,888.00 |
| Total estimated saving for year | | | \$140,093.82 |

Having effected these changes it cannot be said that the problems incident to water supply have been altogether overcome. On the contrary, the conditions at some points are still far from ideal. Between Yuma and Tucson, for instance, the quality of the water leaves much to be desired. An engine with new flues will only last about four months in this territory, a condition which is partially met by transferring the engines east of Tucson, where about three months' more service is secured from them. As a matter of fact, seven or eight months is the average life in flues in any engine operating through the desert. Also during periods of heavy business it is necessary to hire a great number of enginemen whose experience has been in good water territories and who have a great many engine failures and delays until such time as they are able to adapt themselves to the water they must use. However, the condition common to the period prior to 1916 and 1917 when an entire division would become blocked and the freight finally backed up to the extent of blocking other divisions owing to water supplies becoming exhausted at one or two points, is now a thing of the past.

We are indebted for this information to William Wilson, division superintendent of the Tucson division.

HIGH SPEED CAUSES TWO WRECKS

EXCESSIVE speed was the result of two fatal train accidents in recent months which have been subjected to detailed investigation by the Bureau of Safety of the Interstate Commerce Commission. One of these on the Texas & Pacific near Maringouin, La., on February 20, was the result of high speed over tangent track in poor condition; the other, which occurred on April 27 on the Pennsylvania Railroad, Pittsburgh-Philadelphia line, near Bennington Station, Pa., was a result of excessive speed on a curve of 8 deg. 38 min., the track in this case being of a relatively high standard of maintenance.

Owing to the death of both the engineman and fireman in the Pennsylvania accident, the evidence as to the cause of the accident is not complete, but testimony by employees and passengers on the train indicates that the speed was between 25 and 45 miles an hour, the upper limit being believed to be more nearly correct. An examination of the locomotive failed to disclose any defect that might be held responsible in any way, while inspection of the track showed that it was in a generally good condition, although the gage was found to be as much as one-half inch tight at a number of places. However, other evidence seems to indicate that the narrow gage had nothing to do with the accident. Furthermore, the fact that no wheel marks were found on the rails near the point of derailment, together with finding of the running board and other portions of the engine on the outside of the curve within a very short distance of the point of derailment indicate that the engine was overturned as a result of excessive speed.

On the Texas & Pacific the accident was a derailment, occurring on a straight and practically level track, extending due east and west. Examination of the track showed that there was a flange mark on the head of the south rail beginning at about the center of the head and extending eastward a distance of about 6 ft., where it reached the outside of the head. The next mark was on a tie on the outside of the south rail at a point about $3\frac{1}{4}$ in. from the base of the rail and about 4 ft. beyond the end of the mark on the head of the rail. Beyond this point there were no marks on the ties for a distance of 16 ft. The track was then badly torn up for a distance of about 400 ft. There were no marks inside the north rail corresponding with those found on the south rail.

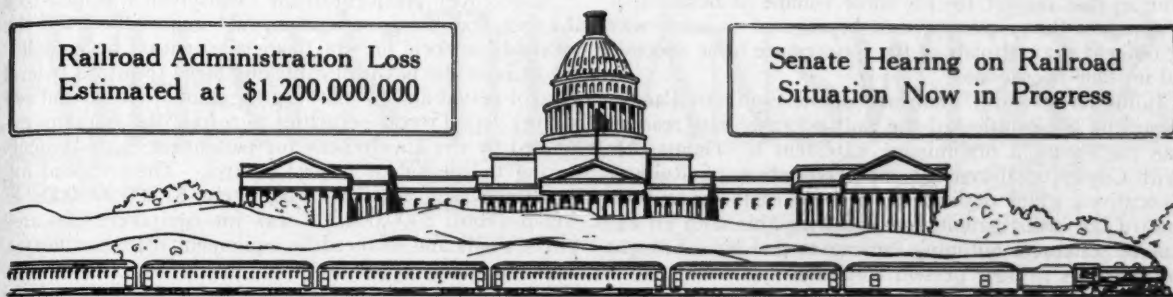
The track in the vicinity is laid with 75 lb. rails, 33 ft. in length, with staggered joints. It is single spiked, supported by an average of about 20 cypress and treated pine ties to the rail and partially tie-plated. The track is ballasted about 16 in. in depth with gravel and was maintained in fair condition.

Measurements made of the surface of the track beginning at the point about $9\frac{1}{2}$ rail lengths west of the point of derailment disclosed considerable irregularity, while two joints were found $\frac{3}{4}$ in. lower than the centers of the adjoining rails. Also with the exception of the centers of two rails the south rail was found to be lower than the north rail for the first 181 ft. of the distance measured, after which it was found to be higher than the north rail for a distance of about 50 ft. and from there on to be $\frac{1}{2}$ to $\frac{3}{4}$ in. lower than the north rail to the point of the accident, a distance of about 100 ft. Observation of the low joints showed that some of them went down about an additional inch under the weight of a slowly moving passenger train. As a result of the examination, therefore, it was concluded that while the train had been moving at a speed in excess of that authorized, the condition of the track was such as to warrant its mention as a joint factor in producing the rocking movement which resulted in the tender's mounting the rail.

RAILWAY AFFAIRS AT THE NATION'S CAPITAL

Railroad Administration Loss
Estimated at \$1,200,000,000

Senate Hearing on Railroad
Situation Now in Progress



Washington, D. C.

THE GOVERNMENT'S loss from the operation of the railroads and other transportation systems during the 26 months of federal control will amount to \$1,200,000,000 instead of \$900,000,000, as estimated by former Director-General Hines. The newer figure has been submitted to the House Committee on Appropriations by J. C. Davis, the present director-general of railroads, in a report on the status of the liquidation of the affairs of the Railroad Administration. Even this estimate, he said, is contingent upon the acceptance of the government's construction of the section of the federal control law prescribing the government's obligation as to the upkeep of the properties of the railroads. Marked differences have arisen between the administration and the carriers as to the liability of the administration for undermaintenance, he said, and if the carriers' contentions are sustained the liability of the administration would be very largely increased, as the differences between the roads and the government will amount to several hundred million dollars.

Up to this time 149 companies have filed their claims on final settlement with the Railroad Administration. This represents about 33.5 per cent in number and about 58.5 per cent in mileage of the entire number of properties, excluding the short lines. The aggregate amount of claims filed to date is \$633,708,281, and, if the remaining claims are filed on the same general lines as the claims already filed, the total amount of claims will aggregate about \$1,250,000,000.

Up to May 1, 1921, 47 roads have been settled with. The aggregate amount claimed by the 47 roads was \$124,040,867, or about 40 per cent of the face of the claims. Mr. Davis says in the report:

"Mr. Hines, in his statement to the Committee on Appropriations, estimated the operating loss of the government for the period of federal control at \$900,478,756.56. This estimate did not include claims of short line railroads, Minnesota forest fire losses, or a sufficient sum for lap-over loss and damage, personal injury, ordinary fire losses, taxes, labor, overcharge, and inland waterways claims, all of which constitute general expenses of the Railroad Administration, and must be considered in estimating any loss that will finally result to the government because of federal control. A reasonable estimate of the amount necessary to liquidate these claims is \$100,000,000.

"In addition to the claims of third persons, above referred to, Mr. Hines failed to make allowance for compensation of non-contract roads in excess of the standard return, undermaintenance of way and structures and equipment, fire losses of carriers' property, and additions and betterments being originally charged to the individual carriers, but which, upon return to private control, and being found useless to the carrier, must be borne by the

administration. The adjustment of these latter claims may require the additional sum of \$200,000,000.

"All of these items of expense were either not considered by Mr. Hines or underestimated, and, as they properly come under the head of general operating expenses incurred by the government, the operating loss in excess of Mr. Hines' estimate will be some \$300,000,000, or instead of an operating loss to the government during the period of federal control, as estimated by Mr. Hines, of \$900,000,000, it will be more nearly \$1,200,000,000.

"It must be borne in mind that this estimate is based on making settlement upon the administration's construction of the upkeep section of the standard contract. Should the Supreme Court ultimately approve the carriers' contention in regard to maintenance, as set out in said upkeep section, the liability of the Railroad Administration would be very largely increased.

"Calling special attention to the claims for undermaintenance, of the claims already filed, aggregating \$633,000,000, \$183,000,000 is for undermaintenance of way and \$176,000,000 is for undermaintenance of equipment, making a total claim for undermaintenance, in the claims already filed, of \$359,000,000. As the claims now filed represent only about 50 per cent of all the claims, it is probable that the claims for undermaintenance will run between \$700,000,000 and \$800,000,000; the Railroad Administration records fail to support claims for overmaintenance sufficient in amount to offset these amounts, and it is quite evident that some allowance must be made on account of undermaintenance."

Senator Cummins, at the railroad inquiry hearing before the Senate Committee on Interstate Commerce on May 13, said he understood from correspondence with the director-general that if the carriers' claims for undermaintenance were allowed the government's loss would reach about \$2,500,000,000 and he thought it safe to estimate it at least \$1,800,000,000, or double Mr. Hines' estimate.

RAILROAD HEARINGS BEFORE SENATE COMMITTEE

Hearings before the Senate Committee on Interstate Commerce, pursuant to the Senate resolution directing an inquiry into the general railroad situation, were begun on Tuesday, May 10. In opening the hearings Senator Cummins, chairman of the committee, said:

"The railroads received during the year, up to March 1, 1921, \$6,175,962,718 as operating revenues. I think it can be said without very much doubt that that is a larger revenue than the railroads will ever receive again for the same volume of business. The operating expenses, together with taxes and the adjustment of equipment rents and joint facility rents, consumed all of that sum except \$2,578,923. So we have before us the problem, I think, of trying to ascertain whether the \$6,000,000,000 and

more received as operating revenues were wisely and economically and efficiently expended. If we cannot increase the revenues, and I think we have reached our limit in that respect for the same volume of business, it is apparent that expenses must be reduced in some way or other if the railroads of the country are to be successful in their operations.

Julius Kruttschnitt, chairman of the Southern Pacific, began the presentation of the railroad case, first reading into the record a preliminary statement by Thomas De Witt Cuyler, chairman of the Association of Railway Executives, which outlined the attitude of the executives toward the investigation, and following this with an extensive statement outlining the causes that have brought the railroads to their present condition.

Mr. Kruttschnitt was followed by Daniel Willard, president of the Baltimore & Ohio, and A. H. Smith, president of the New York Central, who gave a detailed analysis of the operations of the railroads for recent years, showing that most of the increase in expenses in 1920 had its origin in the period of federal control, because in addition to the wage increase resulting from the award of the Labor Board there were other increases resulting from wage orders and the national agreements made by Director-General Hines in the latter part of the period of federal control. There were also increases in fuel and material prices and a part of the increase was due to the increased business handled in 1920, which was greater than for any previous year in railroad history. It was also shown that the rate increase, which was in effect for only four months of 1920, in reality never produced so much of an increase in revenue as it was expected to even before the decline in traffic. Whereas the average percentage of the rate increase was about 34 per cent, it never produced more than a 26 per cent increase in the receipts per ton mile, due to adjustments, exceptions and the failure of some of the states to put it into effect, whereas the wage increase and some other items of expense had been underestimated. Mr. Willard presented a calculation showing that if both the wage advance and the rate increase had been in effect for the full year 1920 the net operating income would have been only about \$540,000,000, or hardly more than half of a 6 per cent return. It was pointed out that the roads are effecting some economies in expenses other than wages.

In response to requests from members of the Senate Committee for suggestions as to what might be done to improve the present system of government regulation of the railroads, Howard Elliott, chairman of the Northern Pacific, urged that railway managements be given the power of prompter action and that the government should use its regulatory powers in a supervisory and corrective way rather than to prevent any action until government approval is first obtained. "It is a very grave question," he stated, "whether regulation has not been overdone, encroached on the field of management, and by dividing responsibility and checking initiative, done more to increase costs, and therefore rates, than would have been the case with more freedom of action permitted.

"Let the railroad managements and the men get together and try to settle their differences, and authorize the railroads to name the rates of pay and working conditions, subject to review by the Labor Board, and subject to reparation if the railroads should do anything that was unfair.

"It would seem as if it was a mistake to attempt to enforce so-called standardization of all wages and rules, which standard, so far as pay is concerned, is a misnomer, because by giving a man the same rate in a little town in northern Vermont that he gets on the outskirts

of New York is really paying the New York man less than the Vermont man, because the latter can live more cheaply."

Samuel Rea, president of the Pennsylvania, emphasized the fact that the government could materially assist the railroads in their present financial situation by completing at once the payments still due them from the federal control period and by allowing the roads to issue and sell six per cent 15-year securities to refund the amounts expended by the government for permanent improvements during the period of federal control. These capital expenditures aggregate approximately \$1,200,000,000, of which almost \$400,000,000 was for equipment allocated to the roads and financed by equipment trust certificates. The remaining expenditure of about \$800,000,000 was chiefly for roadway facilities. "Under the terms of the Transportation Act," Mr. Rea said, "discretion was conferred upon the president to fund all these expenditures, but the right was conferred upon him with certain limitations to offset against such expenditures, amounts due from the Railroad Administration to the carriers on other accounts for the period of federal control. These arrangements should be altered if the carriers cannot meet them, as it is impossible for the railroads to sell securities and to pay off all of these capital expenditures at present, as they now have a shortage of working capital and practically no surplus earnings."

Mr. Rea also declared government promises to maintain the lines in as good condition as when taken over should be fulfilled in letter and spirit. He estimated under maintenance claims of the carriers against the government will aggregate \$700,000,000.

The railroads witnesses have confined themselves to explaining the situation and have proposed nothing that the government should do for them outside of the proceedings before the Labor Board, and none of the members of the committee have proposed any plan of legislation.

PRESIDENT LEAVES RAILROAD PROBLEM TO I. C. C. AND LABOR BOARD

President Harding and his cabinet practically dropped their consideration of the railroad problem except as interested observers for a time, having decided that it offered no opportunity for executive action, but was properly left rates, but after having gathered more information they have apparently seen that any general rate reduction is out of the question until after there has been a readjustment of wages and other expenses. President Harding talks with the newspaper correspondents twice a week after the cabinet meetings and on four or five occasions he has stated that the railroad question was not considered. However, the financial position of the roads came up for discussion at a meeting of the cabinet on May 31, at which consideration was given to the suggestions made by Mr. Rea, (1) the immediate payment to the railroads of the amounts still due from the government as compensation for the period of government operation; including claims for under-maintenance and other unsettled items, and (2) the refunding into 15 year six per cent obligations of the \$800,000,000 which the railways owe the government for capital expenditures made during the period of government control.

FREIGHT CAR LOADING

Freight car loading for the week ended May 15 showed an increase of nearly 90,000 cars, as compared with the week ending April 2, according to the weekly report of the Car Service Division of the American Railway Association. The total was 750,158, as compared with 666,642 cars for the week ended April 2. This represents a steady increase over a period of six weeks.



THE ASKING and answering of questions relating to the daily work of maintenance men frequently feature in the meetings of the various maintenance of way organizations. Beyond doubt this forms one of the most practical and profitable activities in which these associations are engaged, although, of course, it does not take the place of the more formal programs. What these annual conventions or local meetings are enabled to do along this line for the association members in their periodic meetings, the *Railway Maintenance Engineer* is endeavoring to do each month. In other words, the "What's the Answer" page comprises a continuous forum for the discussion of the knotty problems in maintenance of way work.

It is the endeavor to present each month questions relating to the four principal branches of maintenance of way and structures, namely, track, bridges, buildings and water service. The publication of the answers is delayed for two months after the questions appear to afford ample time for those having the necessary information to prepare answers.

TESTING LINE AND SURFACE

Can a roadmaster learn more about the condition of line and surface by riding in an engine cab than by riding on the back end of a train?

FIRST ANSWER

From an experience of 20 years as a maintenance officer, the writer is convinced that each of these means has its advantages. The first is more useful on freight lines, while the latter is to be preferred on passenger lines.

The special advantage in observing the line and surface from a coach carried on the rear end of a train is that the test is made distinctly from the passenger's standpoint. The examination is also more complete, because opportunity is afforded both to note the occurrence of a its individual advantages. In the maintenance of a road devoted mainly to passenger traffic the latter method will give better results, while on a freight road the former defect, and to determine its cause through continued observation within the limits of vision. When riding on the locomotive, a rough place that has escaped the eye

is being passed over at the moment that its presence becomes known through the jar produced. Special testing machines, and particularly the water glass for obtaining "spills," can only be used satisfactorily in the rear of the last coach or on the rear platform.

The test in the engine cab is particularly useful on freight lines, or generally on those where maintenance requirements are moderate. The principal objects then sought are safety and a degree of upkeep which will avoid undue strain upon the locomotive or cars. Thus, minor defects are eliminated from consideration, and only the rougher places will be noted.

There is, however, no question but that a study of the line feature alone can best be made from an engine cab, not only because of the more distinct impression made in approaching rather than in receding from an object, but also because of the greater height of the eye while making the observation. It seems to the writer, therefore, that the roadmaster well may employ on occasion both means of testing his subdivision.

W. F. RENCH.

SECOND ANSWER

My observation is that some engines of long, rigid wheel base will ride more smoothly over a given piece of track than an engine of shorter rigid wheel base. Therefore, the kind of engine must be considered.

I find that the Pacific type of passenger locomotives with the three driving axles with maximum allowance of lateral with a high

speed will give the rider more information as to the exact condition of surface than any other rolling stock. As to line, there is no better way of checking it than standing exactly over the rail, which can best be done on the rear of a train.

J. MORGAN, supervisor, Central of Georgia, Goodwater, Ala.

SAVING STATION FLOORS

What is the most serviceable floor finish for a hardwood floor in stations of medium size?

A railway station floor receives hard usage. It carries a "heavy traffic" and it gets dirty. Therefore, the var-

What Is Your Answer?

The following questions have been submitted to be answered in the August issue:

- (1) Why continue the time honored practice of surfacing the low rail on a main line curve by sighting along the outside of the rail in preference to sighting along the gage side?
- (2) Under what conditions is it necessary to waterproof a concrete slab or arch structure carrying ballasted track?
- (3) What can be done to get better service out of downspouts and gutters on station buildings?
- (4) Should a cast-iron pipe be laid so that the water would flow from the spigot end of the pipe into the bell end or the reverse? Is the answer affected if the pipe is on a steep slope, say, up to 45 deg.?

nish and wax covered shellac finishes will not usually serve the purpose. They soon become badly worn, in which condition they look worse than no finish at all. Another objection is that they will not stand the washing and mopping necessary to keep the floor clean. In my experience boiled linseed oil serves as the most satisfactory dressing for station floors. The oil is not really a finish since it soaks into the wood, rather than form a coating on the surface. Because of this and the fact that it tends to give the wood a darker color, the oiled floor does not give as fine an appearance as one that has been varnished or waxed. On the other hand, the oil has the advantage that it is not so readily affected by wear, while the wood is protected against swelling and warping as a consequence of washing or flooding with water.

A HOME-MADE STUFFING BOX

What is the most practical way of packing a two-inch shaft where it passes through the side or bottom of a wooden water tank?

FIRST ANSWER

A practical device for this purpose can be made entirely from pipe fittings, the work requiring the cutting of a hole through the tank bottom, attaching pipe flanges on the upper side and under side of the floor and into each of these pipe flanges screwing a close nipple and a pipe cap, the caps being drilled to accommodate the revolving shaft. For a two-inch shaft, 3½-or 4-in. pipe fittings should be used in order to leave sufficient space between the shaft and the nipple for the packing. When the fittings are assembled and the shaft inserted, the packing is applied from the top, the pipe cap being removed for this purpose. This pipe cap when screwed back into place compresses the packing and may be utilized as a bearing simply by clamping a plate to the shaft above it.

SUPERVISOR OF WATER SERVICE.

SECOND ANSWER

The most practical way of packing a shaft is by means of a cast iron packing box secured to the side or bottom of the water tank, as, for example, like the packing box carrying the impeller shaft of a centrifugal pump.

S. M. CASE, supervisor of water service, Chicago & North Western, Belle Plaine, Ia.

A MIXER SHOULD BE ON WHEELS

Should a concrete mixer that is used for culvert station platforms and similar work, and frequently moved from place to place on cars be mounted on wheels or skids?

FIRST ANSWER

In my work I have always used mixers that were mounted on wheels. They are loaded and unloaded on the wheels, and after loading the wheels are taken off and the mixer properly anchored to the car. This is also true in many instances when the mixer is set up for use. In other cases they are left on and the mixer is blocked up to reduce vibration in the frame.

Personally, from my observation while supervising this class of work, I believe that these mixers should be mounted on wheels, as is our general practice. There is no doubt in my mind that in all small jobs the time consumed in moving is a very important factor in the cost of the work, hence we should have a mixer that can be moved readily.

H. WUERTH, assistant engineer, Chicago, Milwaukee & St. Paul, Chicago.

SECOND ANSWER

It is my experience there is considerable advantage in having the mixer mounted on wheels since this enables it to be rolled around to any portion of the job. This advantage outweighs any disadvantage which the wheels may cause in fastening the mixer securely when it is being shipped on a flat car.

J. MORGAN, supervisor, Central of Georgia, Goodwater, Ala.

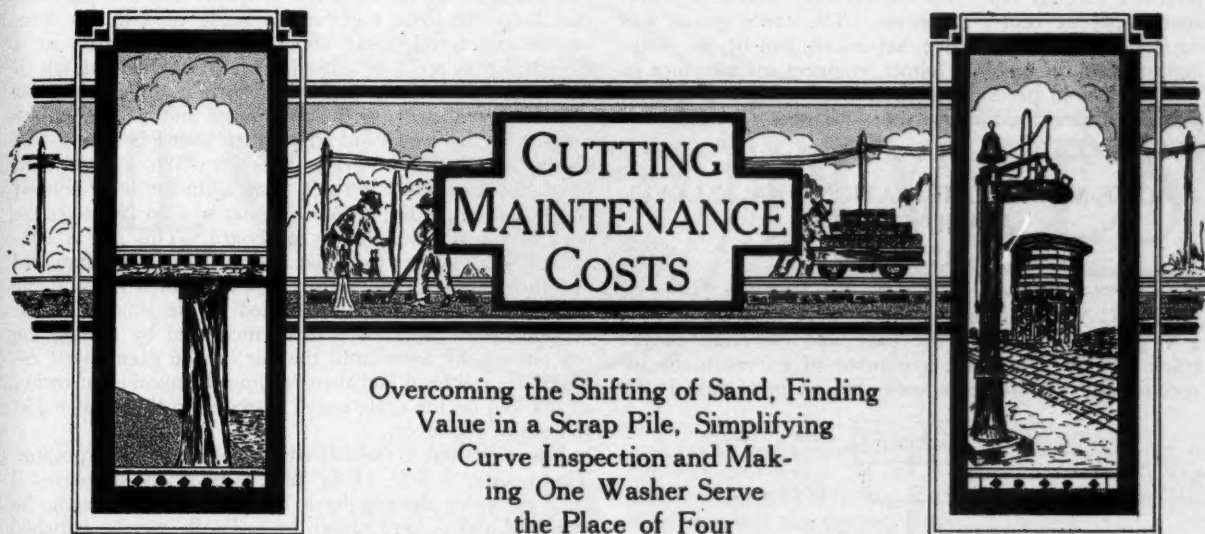
LARGE PAYMENTS BY THE GOVERNMENT TO THE RAILROADS

THE TREASURY Department of the United States has issued a statement dated May 17 showing that a total of \$598,205,851.78 has been paid to the railroads under various provisions of the Transportation Act. This includes the following:

| | |
|--|----------------|
| Reimbursements of deficits under federal control | 1,118,500.10 |
| For payments as provided for the guarantee period | 401,398,364.68 |
| For partial payments for deficits during federal control | 510,500.00 |
| For loans from the revolving fund of \$3,000,000. | 195,178,487.00 |

Certificates for partial payments on account of the six months' guarantee period issued subsequent to those listed in the May issue are as follows:

| | |
|--|-----------|
| Alabama Central | \$ 3,000 |
| American Railway Express Company | 1,500,000 |
| Baltimore & Ohio Chicago Terminal | 735,000 |
| Buffalo & Susquehanna | 100,000 |
| Buffalo, Rochester & Pittsburgh | 97,500 |
| Carolina & Northwestern | 59,500 |
| Charleston & Western Carolina | 260,000 |
| Chicago, Burlington & Quincy | 650,000 |
| Chicago, Indianapolis & Louisville | 125,000 |
| Chicago, St. Paul, Minneapolis & Omaha | 227,000 |
| Chicago, Terre Haute & Southeastern | 26,000 |
| Chicago, Terre Haute & Southeastern | 23,000 |
| Chicago, West Pullman & Southern | 22,000 |
| Cincinnati, Indianapolis & Western | 230,000 |
| Cincinnati, Lebanon & Northern | 150,000 |
| Cleveland, Cincinnati, Chicago & St. Louis | 470,000 |
| Copper Range | 150,000 |
| Deering Southwestern | 4,000 |
| Delaware & Hudson | 500,000 |
| Georgia Southern & Florida | 130,000 |
| Grand Rapids & Indiana | 780,000 |
| Gulf & Ship Island | 20,000 |
| Hawkinsville & Florida Southern | 10,000 |
| Illinois Central | 2,000,000 |
| Illinois Northern | 35,000 |
| Kansas, Oklahoma & Gulf | 90,000 |
| Lehigh & Hudson | 200,000 |
| Louisville, Henderson & St. Louis | 175,000 |
| Marion & Rye Valley | 8,800 |
| Meridian & Memphis | 9,000 |
| Michigan Central | 650,000 |
| Mississippi Central | 245,000 |
| Missouri & North Arkansas | 22,500 |
| Montpelier & Wells River | 64,500 |
| New Orleans Great Northern | 105,500 |
| Norfolk & Western | 2,000,000 |
| Northern Alabama | 80,000 |
| Paris & Mt. Pleasant | 20,000 |
| Philadelphia & Reading | 350,000 |
| San Antonio, Uvalde & Gulf | 65,000 |
| Savannah & Statesboro | 1,500 |
| St. Paul Bridge & Terminal | 7,000 |
| Sullivan County | 17,000 |
| Tennessee Central | 80,000 |
| Texas & Pacific | 125,000 |
| Texas Short Line | 6,000 |
| Toledo, Peoria & Western | 175,000 |
| Vermont Valley | 45,000 |
| Virginia Southern | 2,000 |
| Western Maryland | 400,000 |
| Wisconsin & Northern | 27,500 |
| Wrightsville & Tennille | 75,000 |



Overcoming the Shifting of Sand, Finding Value in a Scrap File, Simplifying Curve Inspection and Making One Washer Serve the Place of Four

SAND SHIFTING PREVENTED BY OIL

BETWEEN the station of Strauss, N. M., and the Rio Grande river the Southern Pacific traverses a section of country about 13 miles in length in which several cuts are made through banks of fine, clean sand, which, when disturbed ever so slightly by the wind, drifts like snow, filling up the cuts and distributing itself upon the rails to the hindrance of the passage of trains. Prior to 1903 it was necessary to clean these cuts after each spring wind and summer rain at an expense of about \$7,000 annually and to maintain a force of section men about five

The oil, when applied, settles into the sand and causes a crust to form almost immediately after the application which effectively prevents drifting until the rains wear down the crust or cut such rivulets in it as will enable the wind to reach the loose grains in the bank. On the basis of three year years' service which each application of oil affords this method is estimated to effect a saving over the former of about \$4,000 per year for this 13 miles of line.

MAKING CATTLE GUARDS FROM SCRAP BOILER FLUES

IN MANUFACTURING cattle guards from scrap boiler flues the Missouri, Kansas & Texas has directed the attention of railroads to another interesting possibility of the reclamation plant. Prior to instituting this practice this road had been selling its scrap at a very low figure and it was thought that a substantial saving could be effected in utilizing the flues to make cattle guards. The road already had a reclamation plant at Parsons, Kan., and it remained only to adopt a standard of design to put the plan into operation. That this plan can be carried out profitably is the consensus of opinion, a test guard installed early in June, 1920, and still in the track, giving evidence of long and effective life.

The flues are cut to lengths of eight feet six inches and



Typical View of Region Sprayed With Oil

months a year to keep the tracks clear. It was then decided to try spraying the banks with oil. The result of the application afforded such success that the Southern Pacific now makes it a regular practice, application of the oil being made every three years at a cost of approximately \$9,000 for oil, labor and work train expenses.

The method adopted for this work consists simply of equipping a flat car with a steam pump and connecting it on a train with an oil car, the locomotive supplying the steam for the pump and the oil being sprayed upon the banks by means of hose equipped with suitable nozzles.



Scrap Boiler Flue Cattle Guard at Parsons, Kan.

pressed flat excepting for eight inches at each end, after which the ends are heated and flattened out on a 45-deg. slope to within six inches of the end on the under side, the remainder thereafter being shaped into supporting flanges. This operation completed, three holes are

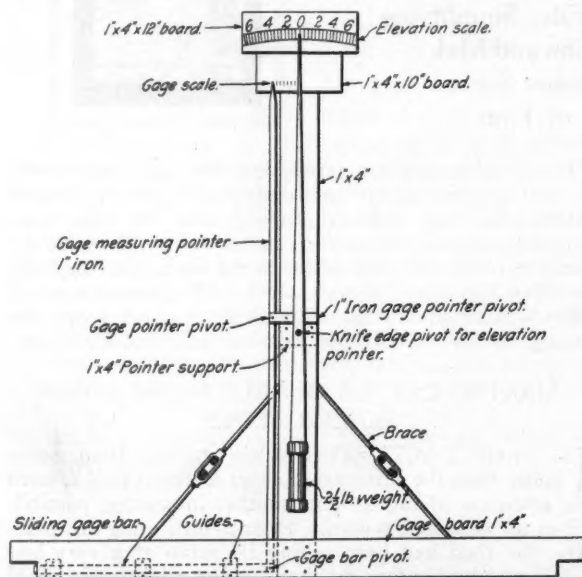
punched in each tube and the sections bolted together, spaced $2\frac{3}{4}$ in. center to center. The cattle guard was designed by H. M. Warden, superintendent of the reclamation plant, and H. H. Johntz, engineer maintenance of way. All cold pressing work is done with a 15,000-lb. steam hammer, the hot pressing by an air-operated bulldozer.

A HOME-MADE COMBINATION TRACK LEVEL AND GAGE

By C. S. Lusk

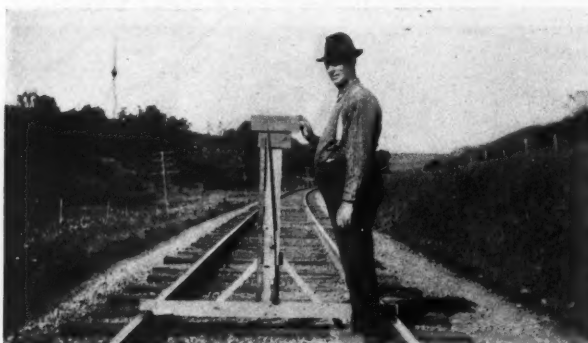
Section Foreman, Erie Railroad, Alfred Station, N. Y.

NEARLY all railroads require curve inspections each year to determine the gage and elevation of the track. Where there are a number of curves to be inspected and the traffic is such that an inspection is re-



Details of the Gage-Level

quired each month or so it is quite a job to do the work well with the ordinary tools. Elevation and gage are commonly taken every $16\frac{1}{2}$ ft. and to determine the condition of the track accurately with the common level and gage requires assistance and a lot of stooping.



The Combined Track Level and Gage in Use

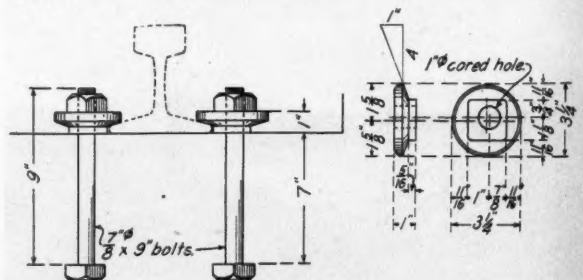
For this work I now use a home-made combined level and gage which enables me to do the work accurately in less time than two men can with a separate level and gage and without having to stoop at any time during the work.

The machine, except for a few strips of iron and the bolts that hold the parts together, is made of 1-in. by 4-in. boards and weighs only about 12 lb. It consists of a wooden cross piece or gage board to the back of which is fastened a vertical standard or upright. This supports a lever for measuring the plus gage and a pointer for measuring the elevation. The gage board is notched at the ends to fit the rail heads and each notch is faced with band iron to protect it from wear. On the back side of this board, in guides, is carried a bar of iron free to move back and forth along the gage board. This bar is connected by a pivot at the inner end to the vertical standard and the vertical bar in turn is supported on a pivot at the center by a strip of iron fastened to the standard, thus enabling plus gage board to be measured by pulling the top end of the lever until the bar on the gage board engages the rail head and then reading the number of inches as marked on the scale board fastened to the standard at the top of the lever.

The elevation is measured by means of the pointer. This pointer is 3 ft. 11 in. long, is pivotally supported 2 ft. 5 in. from the top by a bolt extending through the standard and is kept plumb by a $2\frac{1}{2}$ -lb. weight attached to the lower end. To prevent the pointer sticking, the bolt supporting it is filed V shape and the hole in the standard is bushed with thin iron. Where the elevation is to be measured, the process consists of setting the machine on the track and reading the number on the scale board at the top of the standard over which the pointer comes to rest. The numbers on this board give the elevation in inches.

AN INGENIOUS GRIP WASHER

THE SECURING of rails to steel or concrete structures with bolts fixed in the concrete or the steel, as is sometimes necessary with track scales, turntable pits, cinder pits, engine pits or special deck bridges, has one important disadvantage. The renewal of the rail with a heavier section will usually cause trouble, for if these bolts have been set to fit one width of rail base they will usually not fit for another width. This difficulty has been overcome on the Canadian Pacific by the use of an eccen-



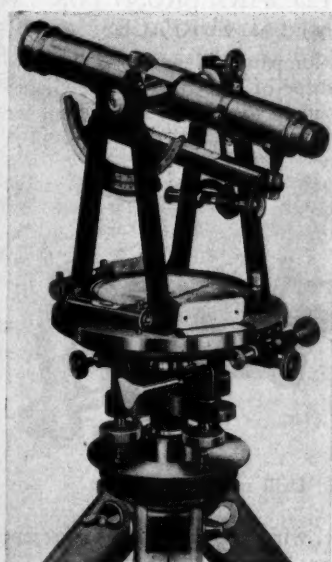
Details of the Washer

tric washer, such as the one shown in the drawing, which was used to hold down the circle rail in a turntable pit. This washer consists of two parts, an upper circular disc with a conical face made to fit the fishing angle of the rail and a lower part comprising a square boss made to fit against the edge of the rail base. Instead of having this square portion concentric with the bolt hole it is offset in both directions so that no two sides are at the same distance from the center of the hole, that is, this distance varies by intervals of $\frac{1}{8}$ in. from a minimum of $\frac{3}{4}$ in. to a maximum of $1\frac{1}{8}$ in. Therefore, with bolts on either side of the rail, changes in the position of the eccentric square of the washer make it possible to vary the width of the space for the rail base a total of $\frac{3}{4}$ in.

NEW DEVICES

RECENT TRANSIT AND LEVEL IMPROVEMENTS

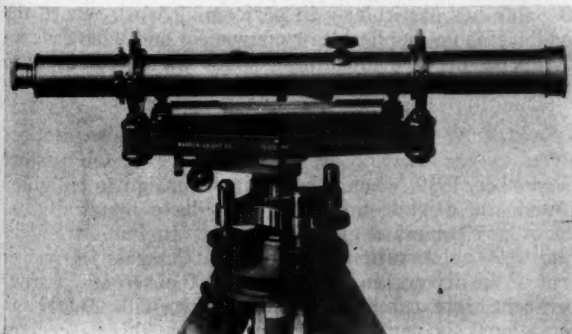
THE WARREN-KNIGHT COMPANY, Philadelphia, has recently made several improvements in its "Sterling" railroad transit and railroad wye level. Three new features are embodied in the transit, one of which is a



Sterling Railroad Transit

special lens combination which enables objects to be seen clearly at as short a distance as four feet. This feature is of particular value to the railroad engineer who very frequently encounters work necessitating his focusing the transit upon points directly at the foot of the tripod. Another new feature of this instrument is an arrangement for removing any sign of stadia wires from the plane of vision when the instrument is being used for level work. This is accomplished simply by giving the milled head on the eyepiece cap a turn. A

third new feature of the transit lies in the system of numbering the limb and verniers. This is called a system of differentiated figures



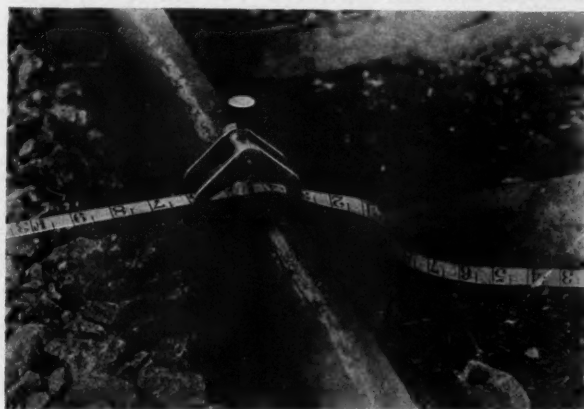
Sterling Railroad Wye Level

and comprises a system whereby all the numbering on the limb and vernier in one direction is done with large numbers slanting to the right, and those in the other direction, with half size figures slanting to the left.

On the railroad wye level the new features consist of a new type of Wye clip locks designed to facilitate quick opening, and a stadia arrangement similar to that embodied in the transit.

AN ENGINEER'S TAPE HOLDER

ENGINEERS and employees of other departments engaged in cross sectioning or other work involving the taking of measurements from or along railway tracks, and particularly those who frequently encounter condi-



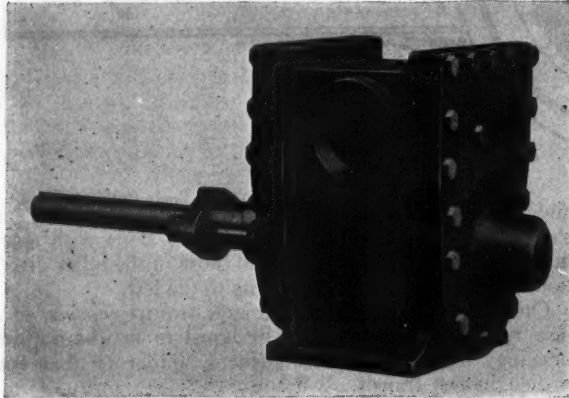
How the Tape Holder Is Used

tions where all the assistance desired for carrying on the work is not conveniently at hand, will be interested in a device recently developed for the purpose of holding the tape to the rail. As the illustration shows, the device consists of two pairs of hooks pivoted on a common axis, and a thumb screw, the hooks being designed to slip over the rail head and to engage it from the under side and the thumb screw being arranged to perform the dual function of drawing the hooks up against the head and clamping the tape to the rail. The device is made of aluminum. It is designed to fold compactly for carrying in the coat pocket, and to afford ready application to or removal from the rail, the operation requiring but a single turn of the thumb screw. The device, the Metal Chainman, as it is called, was designed by F. T. Morse, assistant engineer on the Atchison, Topeka & Santa Fe, Topeka, Kan., and

is manufactured by the Eugene Dietzen Co., Chicago. This is said to be an improvement over the spring clip as originally designed by the same inventor.

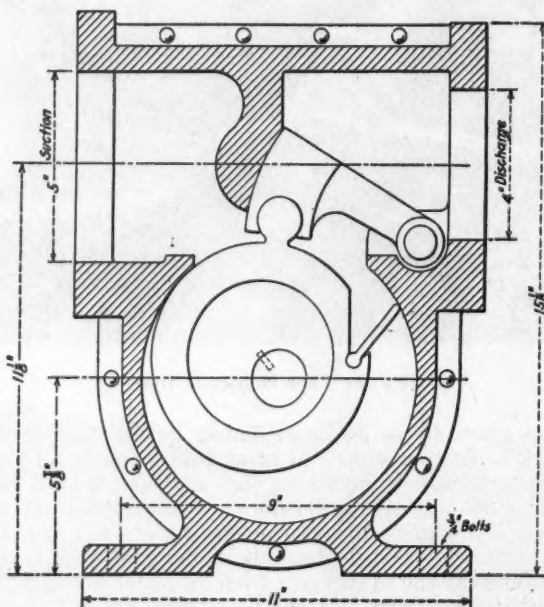
AN INGENIOUS ROTARY PUMP

A NEW pump following the rotary principle has been placed on the market which is unique in many respects. It is also said to correct many of the weaknesses common to pumping devices. The mode of operation is



The St. Louis Rotary Pump

readily understood from the outline cross section of the pump. There are only 12 major parts, consisting of a pump case with dividing partition, two end plates, a steel shaft with two eccentrics mounted thereon, two pistons, two rocker arms and two checks. Two chambers or cylinders are arranged, with a shaft passing through the center of each, two eccentrics, directly opposite in throw or 180



Sectional View of Rotary Pump

deg. apart, being mounted on the shaft. Surrounding these eccentrics and pivoted to the rocker arm are the two pump pistons. The arm serves to produce the reciprocating movement of the piston through the cam action of the eccentrics and it is seen that the piston in its motion with the eccentric will entrap a certain quantity of

water each revolution and carry it to the outlet chamber.

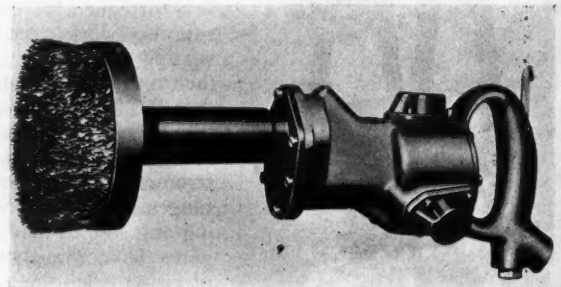
The piston check is the only moving part touching the cylinder walls and this functions only at the point of transition at the end of the pumping suction movement or stroke to the beginning of a new stroke. The wear on this check is taken up automatically. The interval between the so-called strokes is so slight that an even impulse is imparted to the liquid handled. While the piston is discharging, it is acquiring fresh liquid on the opposite or suction side, and the piston in the opposite chamber is functioning conversely, thus giving balanced action.

The construction is entirely of metal most suitable for the liquids handled, so arranged that no two similar metals are in contact at any bearing point. All wearing parts on the pump are rotative and at every point at which wear may be encountered even to a minor degree, self-lubricated bearings capable of long service are used.

The head at one end of pump case is blind; that is, the shaft does not extend through and this eliminates packing. At the other end, a gland which holds the packing material is bolted to the head. The pump is compact, light in weight, practically free from vibration, durable and self-lubricating when handling either volatile or non-volatile oils or similar liquids. It is manufactured by the St. Louis Pump & Equipment Company, St. Louis, Mo.

AN AIR OPERATED WIRE BRUSH FOR CLEANING METAL SURFACES

THE Ingersoll-Rand Company, New York, has recently enlarged the scope of its No. 6 "Little Giant" pneumatic drill by developing a wire brush attachment for use with it. This brush is five inches in diameter and is



No. 6 Little David Drill with Wire Brush

made of heat-treated steel wire, which is said to present excellent wearing qualities. Applied to the drill as an ordinary bit, a useful outfit is provided for work involving the removing of paint, rust, scale and dirt from tanks, steel cars, structural steel work, etc., and also for cleaning iron, steel and aluminum castings. Combining compactness with lightness (the outfit weighs 11 1/2 lb.), its value lies particularly in performing work where the sandblast is not applicable or convenient and where cleaning operations by manual means alone are so tedious as to cause neglect at the hands of the workmen.

SAFETY AT GRADE CROSSINGS.—Four million notices given to car owners by the Baltimore & Ohio since November, 1919, when it began its campaign to enlighten automobile drivers, are believed to have materially reduced carelessness at grade crossings. In January of this year, 8,000 observations, disclosed carelessness in five per cent of the drivers; in February, 17,000 observations, four per cent were careless; and in March, with 23,000 observations, six per cent. Two years ago this percentage was about 25, and in 1920, 16 per cent.



AMERICAN RAILWAY ENGINEERING ASSOCIATION

That the work of the regular standing committees is well under way may be judged by the number of committee meetings which have been held since the latter part of April. During the month of May alone, 13 committee meetings were held, most of them in Chicago, although a few took place in New York. These included meetings of the committees on: Economics of Railway Location; Electricity; Rail; Iron and Steel Structures; Water Service; Rules and Organization; Signs, Fences and Crossings; Ties; Terminals; Records and Accounts; Wood Preservation; Masonry; and Economics of Railway Labor.

The Board of Directors of the association was scheduled to hold a regular board meeting at Montreal during the month of June, but it has been found necessary to postpone this meeting until some time in July. The secretary and the committee chairmen are now busy compiling and editing material for the 1921 edition of the Manual, which will be ready for distribution about the first of September. This important work will be considerably larger than any of the previous editions, it being estimated that it will contain approximately 1,000 pages, which will be printed on thin paper like that used for the Proceedings in order to avoid too thick a volume.

BRIDGE AND BUILDING ASSOCIATION

A meeting of the executive committee was held in Chicago on Saturday, May 21, at which a report was received from the committee in charge of arrangements for the next convention. It was tentatively decided that arrangements should be made for the members from points north and west of Chicago to leave that city on Sunday afternoon, October 16, arriving in New York late the following afternoon. It is expected that a sufficient number will go to enable a special train to be secured.

THE METROPOLITAN TRACK SUPERVISORS' CLUB

Thirty-five track supervisors on railroads in the vicinity of New York met in that city on May 14 to form the Metropolitan Track Supervisors' Club, the purpose of which is to afford an opportunity for the discussion of problems connected with the maintenance of railway tracks. While this organization has no connection with the Roadmasters' and Maintenance of Way Association, many members of the club are also members of the latter organization. For this reason it was decided to include among the subjects for discussion those which will be presented at the next convention of the Roadmasters' Association in order that the members of the club may be better prepared to discuss them at the convention next September. Coleman King, supervisor on the Long Island Railroad at Jamaica, N. Y., was elected chairman of the club; George W. Morrow, supervisor on the New York, New Haven & Hartford at New Haven, Conn., vice-chairman, and S. A. Hart, supervisor of the Pennsylvania Railroad at Mt. Holly, N. J., secretary and treasurer. The next meeting will be held on June 25.

THE MATERIAL MARKET

SINCE the reduction in prices announced last month by the United States Steel Corporation, a further reduction has been announced covering track spikes, track bolts and steel tie plates, the new prices being 3.40, 4.35 and 2.50 cents per lb., respectively. While some sales have been recorded since the first of the year at prices lower than those named above, it may be said that these new prices represent real concessions from those generally prevailing. The price of steel angle bars, namely, 2.75 cents per lb., has not been modified.

Taking it as a whole, the prices established by the corporation have not been holding very well since they were put into effect, so that it is possible to get concessions below the listed base prices. Some shading has been noted in the case of track spikes, which are said to have sold recently for 3.10 cent, and for wire nails, which have been sold at 3.0 cents. Marked cuts in the price of cast iron pipe indicate that a new base price may be expected soon.

One tendency in the iron and steel market which has been watched with some interest is a reduction in the spread between the price of plain material and the price of fabricated steel, indicating that the fabricators are willing to take work at a much smaller margin than for some time in the past. Contracts for girder spans are being taken at less than 4 cents per lb. f. o. b. shops.

| | Prices in Cents Per Pound | | | |
|---|---------------------------|---------|------------|---------|
| | April 20 | | May 20 | |
| | Pittsburgh | Chicago | Pittsburgh | Chicago |
| Track spikes | 3.65 | 4.03 | 3.40 | 3.78 |
| Track bolts | 4.60 | 4.98 | 4.35 | 4.73 |
| Angle bars | 2.75 | ..... | ..... | 2.75 |
| Tie plates, steel | 3.00 | ..... | ..... | 2.50 |
| Tie plates, iron | 3.00 | ..... | ..... | 3.00 |
| Plain wire | 3.25 | 3.63 | 3.00 | 3.38 |
| Wire nails | 3.25 | 3.63 | 3.25 | 3.63 |
| Barbed wire, galv. | 4.10 | 3.48 | 4.10 | 3.48 |
| C. I. pipe, 6 in. or larger (per ton) | 64.10 | ..... | 64.10 | ..... |
| Plates | 2.20 | 2.58 | 2.20 | 2.58 |
| Shapes | 2.20 | 2.58 | 2.20 | 2.58 |
| Bars (steel) | 2.10 | 2.48 | 2.10 | 2.48 |

The scrap market has taken a turn and some increases in prices have been noted, but in view of the present condition of the industry it is questioned whether the advanced prices can be maintained.

| | Chicago | | St. Louis | |
|------------------------------------|---------------|---------|---------------|---------|
| | Per Gross Ton | | Per Gross Ton | |
| Relaying rails | \$30.00 to | \$35.00 | \$27.50 to | \$32.50 |
| Rerolling rails | 13.25 to | 13.75 | 12.50 to | 13.00 |
| Rails less than 3 ft. long | 14.00 to | 14.50 | 12.50 to | 13.00 |
| Frogs and switches cut apart. | 11.50 to | 12.00 | 12.50 to | 13.00 |
| | Per Net Ton | | Per Net Ton | |
| | | | | |
| No. 1 railroad wrought | 10.00 to | 10.50 | 10.50 to | 11.00 |
| Steel angle bars | 11.50 to | 12.00 | 11.00 to | 11.50 |

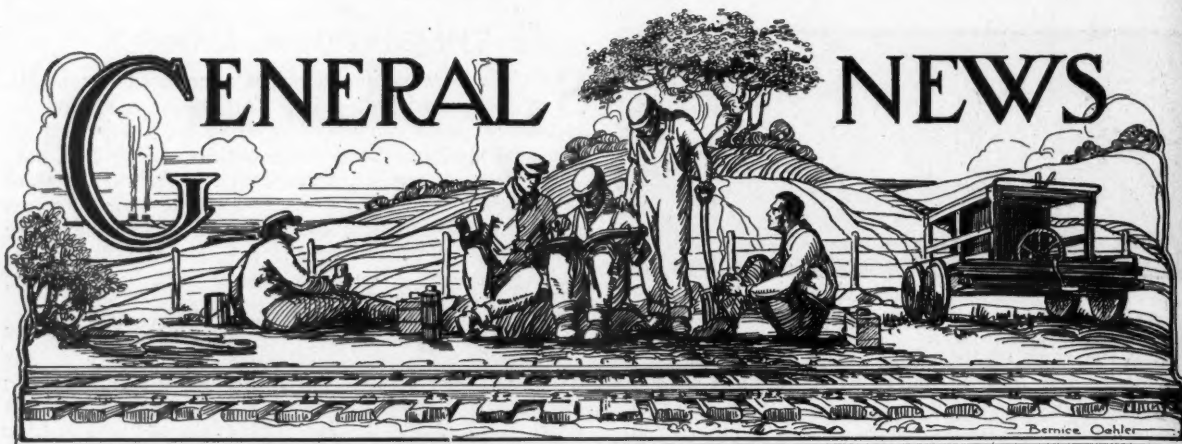
The lumber prices, as indicated by the comparisons of April and May prices given below, show a somewhat erratic tendency. Some of the prices are higher and others are lower than they were a month ago.

Southern Pine Mill Prices

| | April | May |
|---|---------|---------|
| Flooring, 1 x 4, B. & B., flat | \$31.45 | \$30.31 |
| Boards, 1 x 8, 14 & 16, No. 1 | 23.82 | 22.75 |
| Dimension, 2 x 4, 16, No. 1 | 20.89 | 21.60 |
| Dimension, 2 x 10, 16, No. 1 | 22.41 | 20.41 |
| Timbers, 4 x 4 to 8 x 8, No. 1 | 20.43 | 19.95 |
| Timbers, 3 x 12 to 12 x 12, No. 1 | 29.93 | 26.75 |

Douglas Fir, Seattle Prices

| | April | May |
|--|---------|---------|
| Flooring, 1 x 4, No. 2 clear, flat | \$21.00 | \$22.00 |
| Boards, 1 x 6, 6 to 20, No. 1 common | 11.50 | 12.00 |
| Dimension, 2 x 4, 16, No. 1, common | 12.50 | 12.50 |
| Dimension, 2 x 10, 16, No. 1, common | 12.50 | 12.50 |
| Timbers, 6 x 6 to 8 x 8, No. 1, common | 20.00 | 17.00 |
| Timbers, 10 x 10 to 12 x 12, rough | 18.00 | 16.00 |



E. M. Chandler, formerly chief engineer, Washington State Reclamation Service, Olympia, Wash., has been elected acting secretary of the American Society of Civil Engineers.

Salaries of railroad officers would be limited to \$15,000 a year, unless a higher figure were approved by the Interstate Commerce Commission, if Congress should pass a bill introduced on April 25 by Representative Black of Texas.

Iron and steel producers at Chicago have filed an application with the transcontinental lines for a readjustment of through rates on rolled steel from Chicago to the Pacific Coast, to enable them to compete with the Eastern mills now enjoying low water rates.

The organized effort of the agricultural associations to secure a reduction of freight rates recently presented itself in a formal appeal to President Harding, urging the consideration of the agricultural interests as well as those of transportation as a part of the national economic problem.

Franklin K. Lane, Secretary of the Interior in the administration of President Wilson and for eight years a member of the Interstate Commerce Commission, died at Rochester, Minn., on May 18, at the age of 56. In 1918 Mr. Lane was chairman of the railroad wage commission.

Lord Shaughnessy, chairman of the Canadian Pacific (acting as an individual citizen and not officially), has written to the Prime Minister of Canada, proposing that all of the government-owned railways of Canada be put into the hands of the Canadian Pacific, to be operated by that company, along with its own lines, as a single system.

F. M. Feiker, vice-president and chairman of the editorial board of the McGraw-Hill Company, publishers of Engineering News-Record and other technical publications, New York City, has been appointed personal assistant to Herbert Hoover, Secretary of Commerce, with the title of assistant to the secretary.

The full crew law of Pennsylvania, which has been in force in that state since July, 1911, was repealed by an act passed by the Legislature last month and since signed by the governor. The House adopted this bill by a vote of 110 to 88. In 1915 the legislature voted to repeal the full crew law, but its action was vetoed by Governor Martin G. Brumbaugh.

Employees of the Chicago, Milwaukee & St. Paul have started a movement to acquire stock in the company. At a recent informal dinner of the employees of the auditor's office, 189 employees subscribed for 379 shares of the stock. They formed the "Action Club" and each employee owning a share of stock will wear a button on which will be inscribed, "I Am An Employee Stockholder."

The appearance and nature of transverse and longitudinal fissures in rails may be readily ascertained from an exhibit of rails containing these defects which is now being shown in the offices of Robert W. Hunt & Co., Chicago. The object of this exhibit is to give railway officers who are not thoroughly familiar with this subject a chance to learn what the transverse and other forms of fissures look like, but of still

greater importance is the opportunity afforded for placing adequate emphasis on the seriousness of these dangerous flaws. One sample shown in this exhibit is particularly impressive in this respect, showing the minute hair cracks on the sides of the ball of the rail which, when visible at all, present practically the only evidence to be had of the transverse fissure before the rail is actually broken. Consequently, this exhibit demonstrates most emphatically how difficult it is to detect a transverse fissure before failure actually takes place.

At the annual convention of the American Association of Engineers at Buffalo on May 9 to 11, inclusive, H. O. Garman, chief engineer, Public Service Commission of Indiana, Indianapolis, Ind., was elected president; A. N. Johnson, dean of engineering, Maryland State College, College Park, Md., first vice-president, and A. S. Morris, auditor, capital expenditures, Chicago & North Western Railway, second vice-president. W. R. McKeen, president of the McKeen Motor Car Company of Omaha, Neb., was elected a director.

The Bureau of Railway Economics has recently compiled a report in which it is shown that the average revenue received by the railroads of the United States for transporting a ton of freight one mile is less under the present rates than it was during the period before the creation of the Interstate Commerce Commission. The report compares the statistics for the years 1882 to 1887, reported in Poor's Manual of Railroads, with those reported by the Interstate Commerce Commission for the years since.

The Safety First campaign on the Chicago & North Western has been productive of splendid results, judging from the following comparison made of the ten years preceding and following June, 1910.

- 417 fewer employees killed, a decrease of 37 per cent.
- 22,600 fewer employees injured, a decrease of 24.7 per cent.
- 4 fewer passengers killed, a decrease of 3.5 per cent.
- 2,003 fewer passengers injured, a decrease of 20.4 per cent.
- 629 fewer outsiders killed, a decrease of 25.3 per cent.
- 330 fewer outsiders injured, a decrease of 5.1 per cent.

The Kansas City Southern and the Los Angeles & Salt Lake have filed motions with the Interstate Commerce Commission asking that the supplemental tentative valuations issued by the commission on March 31 be amended to set forth an analysis of the methods of valuation employed and the reasons for any difference between the final value found and the cost schedules or cost values stated by the commission. It is stated that the valuation act requires such an analysis of the methods and that the commission in failing to give it has not complied with the plain and express terms of the valuation act. The Kansas City Southern motion states that the carrier is deprived of the right given by the valuation act to protest against the rules, principles, methods and procedure which have been employed and that it cannot prepare intelligently its protest against the supplemental tentative valuation. The Los Angeles & Salt Lake has also filed a protest against the supplemental tentative valuation stating that a valuation as of June 30, 1914, will not comply with the act or serve any purpose thereunder.

PERSONAL MENTION

ENGINEERING

J. H. Babbitt, formerly assistant engineer of the Akron division of Pennsylvania, has been appointed assistant engineer of the New Castle division of the Baltimore & Ohio.

A. M. Davidson has been appointed assistant division engineer of the Baltimore & Ohio, with headquarters at Chilli-cothe, Ohio, in place of **J. W. Purdy**, appointed supervisor of track, as noted elsewhere.

W. S. Hanley was appointed chief engineer of the St. Louis-Southwestern, with headquarters at Tyler, Tex., on May 10, to succeed **A. A. Mathews**, resigned. Effective the same date, **C. C. Pettigrew**, formerly division engineer, with headquarters at Illmo, Mo., was appointed division engineer of the combined Illmo and Pine Bluff divisions, with headquarters at Pine Bluff, Ark. **W. N. Raleigh**, division engineer, with headquarters at Pine Bluff, has resigned, his position having been discontinued.

F. L. Wheaton, division engineer on the Delaware, Lackawanna & Western, with headquarters at Binghamton, N. Y., has been transferred to Buffalo, succeeding **G. E. Boyd**. Mr. Wheaton will have jurisdiction over both the Buffalo and the Scranton divisions, the office of division engineer at Binghamton having been abolished.

W. J. Foster, regional engineer on the Erie, with headquarters at Hornell, N. Y., has been appointed division engineer, with headquarters at Buffalo. The office of regional engineer at Hornell has been abolished. **F. S. Wheeler**, division engineer, with headquarters at Buffalo, has been transferred to Salamanca, N. Y., in place of **C. A. Daley**, who has been appointed chief of corps, with the same headquarters. The position of assistant division engineer at Hornell and Buffalo has been abolished.

In connection with the consolidation of divisions on the Chicago, Rock Island & Pacific, announced in last month's issue, **J. G. Bloom**, division superintendent at El Dorado, Ark., was appointed division engineer at Fairbury, Neb., instead of Colorado Springs, Colo., as noted in last month's issue. **C. P. Richardson**, division engineer, was appointed assistant engineer at Estherville, Iowa, instead of Fairbury, Neb. **B. A. Wait**, assistant engineer at Estherville, Iowa, was appointed instrumentman at Des Moines, Iowa, instead of Fairbury, Neb., as stated in the May issue.

W. S. Hanley, recently appointed chief engineer of the St. Louis Southwestern, with headquarters at Tyler, Tex., as announced elsewhere in this issue, was born at Terre Haute, Ind., on September 9, 1877. He was educated at Rose Polytechnic Institute, Terre Haute, and entered railroad service in 1902, as an assistant in the engineering corps, of the Pennsylvania, being assigned to the Logansport division. In 1905 he was appointed assistant division engineer of the Chicago & Eastern Illinois, with headquarters at Danville, Ill., and was later promoted to principal assistant engineer, with headquarters at Chicago. In 1912 he was appointed chief engineer of the New Orleans Great Northern, and was serving in that position, with headquarters at Bogalusa, La., at the time of his recent appointment.

E. K. Mentzer, whose promotion to division engineer on the Boston & Albany, with headquarters at Springfield, Mass., was noted in last month's issue, was born at Martinsburg, Pa., on May 3, 1885. Mr. Mentzer graduated from the Pennsylvania State College in 1910 and immediately entered railway service as a rodman on the Pennsylvania Railroad at Reading, Pa. On May 9, 1911, he left the Pennsylvania to enter the employ of the Boston & Albany as a draftsman at Boston, Mass., serving in this capacity until January 1, 1913, when he was promoted to assistant engineer, with the same headquarters. On March 1, 1914, he was promoted to supervisor of bridges and buildings at Worcester, Mass., remain-

ing in this position until June 16, 1918, when he was promoted to supervisor of track at Boston, where he remained until his recent promotion to division engineer.

C. R. Mee, whose appointment as chief engineer of the Louisiana Railway & Navigation Company, with headquarters at Shreveport, La., as announced in last month's issue, was born at Post Oak Springs, Tenn., on August 1, 1880, and entered railway service in 1898 as an axeman on the Tennessee Central. In 1900 he entered the service of the Lake Erie, Alliance & Western, as assistant to the resident engineer, and in 1901 he went with the Pittsburgh, McKeesport & Youghiogheny as a transitman on location. Later in the same year he was appointed assistant to the division engineer on the Wabash and served in that position until February, 1903, when he was appointed locating engineer of the Louisiana Railway & Navigation Company. He was promoted to general roadmaster in 1908 and served in that capacity until December, 1918, during part of which time he also assumed the duties of chief engineer. On the latter date he left railroad service to take up private engineering practice and was engaged in this work until he returned to the service of the road, as above noted.

William Hood, chief engineer of the Southern Pacific, Pacific System, with headquarters at San Francisco, Cal., retired last month after an active career of 54 years, which may be said to cover that entire period of great railway expansion in the western portion of the United States in which he played so important a part. Particular interest arises from the fact that his connection with this great work dates back to the building of the first transcontinental line, for in 1867, as a young man of 21, just out of Dartmouth College, he obtained a position as rodman on the construction of the Central Pacific through the Sierra Nevada mountains. Mr. Hood continued his connection with this one road and its successor, the Southern Pacific,



William Hood

from that time until his resignation a month ago, serving in various positions including a period of nearly 37 years as chief engineer. Much of Mr. Hood's success has been ascribed to his profound knowledge of the physiography of the western states and his ability as a railway locator. He was intimately identified with the location of practically all of the Southern Pacific Lines, during the course of which he resorted to a wide variety of original engineering methods. Among important pieces of work carried out under his direction are the Tehachapi loop, the Siskiyou "S" line, and Cariso Gorge line of the San Diego & Arizona, but of possibly greatest importance was the Lucin cut-off, the causeway and trestle across Great Salt Lake. His advancement on the property in which he entrusted his fortunes was rapid. In less than a year following his employment he was made assistant engineer and in June, 1872, he became an assistant engineer on the Southern Pacific. In 1875 he was promoted to assistant chief engineer of the Southern Pacific, continuing in this position until 1883, when he accepted a similar position with the Central Pacific. He was promoted to chief engineer of that road on October 10, 1883, but in August, 1885, he returned to the Southern Pacific as chief engineer of the Pacific System. On June 1, 1900 he was promoted to chief engineer of the Southern Pacific.

William A. Duff, assistant chief engineer of the Canadian National, Eastern Lines, has been promoted to engineer of standards of the Canadian National-Grand Trunk Pacific, with headquarters at Toronto, Ont. Mr. Duff was born at

Hamilton, Ont., on April 20, 1877, and graduated from the University of Toronto in 1901. He entered railway service in 1901 with the Vancouver, Victoria & Eastern as a draftsman, later serving as assistant resident engineer. From 1902 until 1903 he served as assistant engineer for the Grand Trunk, leaving in the latter year to go with the Kenwood Bridge Company, Chicago, as a draftsman. In 1905 he was appointed a draftsman with the Canadian Bridge Company of Walkerville, Ont., and from 1907 to 1908 served as chief draftsman in the bridge department of the National Transcontinental Railway, with headquarters at Ottawa, Ont. In 1908 he was promoted to assistant bridge engineer. Mr. Duff was appointed engineer of bridges of the Canadian Government Railways in 1913, which position he held until October 1, 1916, when he became assistant chief engineer. On January 1, 1919, he was appointed assistant chief engineer of the Eastern Lines of the Canadian National, which position he held at the time of his recent appointment.

Duval M. Lamdin, division engineer on the Atlantic Coast Line, with headquarters at Waycross, Ga., has been promoted to engineer of construction with headquarters at Wilmington, N. C., succeeding C. M. James, resigned. Mr. Lamdin was born at Baltimore, Md., on September 9, 1880 and was educated at the Baltimore Polytechnic Institute. He entered railway service as a rodman in the engineering department of the Baltimore & Ohio in 1899, and subsequently held various positions in that department up to resident engineer. In the spring of 1904 he left the employ of the Baltimore & Ohio to enter the service of the Atlantic Coast Line as a masonry inspector, remaining in this position for two months when he was promoted to assistant engineer. In December, 1914 he was promoted to pilot in the valuation department of that road. In October, 1920 he was promoted to division engineer at Waycross where he remained until his recent promotion as noted above.

TRACK

J. W. Purdy, assistant division engineer on the Baltimore & Ohio, with headquarters at Chillicothe, Ohio, has been appointed supervisor of track, with headquarters at Zanesville, Ohio.

P. Bohan, roadmaster of the Oba subdivision of the Canadian National, with headquarters at Hornepayne, Ont., has been transferred to the Ruel subdivision, with headquarters at Capreol, Ont., succeeding **P. Vicks**, transferred to the Oba subdivision, with headquarters at Hornepayne, Ont., succeeding Mr. Bohan.

C. T. Vance, roadmaster on the Murphy division of the Southern Railway, with headquarters at Ashville, N. C., has been appointed assistant roadmaster on the Asheville division, retaining the same headquarters and having jurisdiction over the line from Murphy Junction to Murphy, N. C. The office of track supervisor on the Murphy division has been abolished.

R. E. Fitzgerald, assistant supervisor of track on the Philadelphia & Reading, with headquarters at Harrisburg, Pa., has been promoted to supervisor of track with headquarters at Boiling Springs, succeeding **W. H. Woltemate**, who has been transferred to Port Richmond, Philadelphia, Pa. Mr. Woltemate succeeds **Luke Fox**, deceased. **S. R. Miller** has been promoted to assistant supervisor with headquarters at Harrisburg, succeeding Mr. Fitzgerald.

R. E. Fitzgerald, whose promotion to supervisor of track on the Philadelphia & Reading is noted elsewhere in these columns, was born at Harrisburg, Pa., on November 28, 1882. He entered railway service as a rodman, and later levelman on construction work on the Choctaw, Oklahoma & Gulf, at Little Rock, Ark., in 1898. In 1900 he left that road to enter the service of the Philadelphia & Reading as a clerk in the office of the supervisor at Boiling Springs, Pa., where he remained until 1915 when he was promoted to chief clerk of the division engineer at Harrisburg, Pa. In 1917 he was promoted to acting supervisor of track at Boiling Springs. In 1918 he was definitely appointed assistant supervisor of track at Harrisburg, where he remained until his recent promotion to supervisor at Boiling Springs.

Janvier Hebert, foreman on the Canadian Pacific, has been promoted to roadmaster of the Dominion Atlantic, with headquarters at Yarmouth, N. S. **F. W. Nichols**, roadmaster on the Ontario district, with headquarters at London, Ont., has been transferred to Lindsay, succeeding **Alexander Mackenzie**, deceased. **J. Cameron**, roadmaster of the Owen Sound and Walkerton subdivisions, with headquarters at Orangeville, Ont., has been transferred to the MacTier subdivision of the Bruce division, Ontario district, with headquarters at Toronto, Ont., succeeding **J. H. Guthrie** who has been transferred to the Owen Sound and Walkerton subdivisions, with headquarters at Orangeville, Ont., in place of Mr. Cameron.

F. H. Depew has been appointed acting roadmaster of the Marysville district of the Southern Pacific, with headquarters at Marysville, Cal., succeeding **J. E. Connolly**, resigned.

J. LaPeen, notice of whose appointment to the position of roadmaster of the Montello district of the Southern Pacific, with headquarters at Montello, Nev., appeared in the May issue, was born in France on February 8, 1877. He entered railway service in 1891 with the Michigan Central as a section laborer, leaving in 1895 to go with the Johnson Steel Company, Lorain, Ohio. From 1901 until 1904 he served as extra gang foreman for the New Mexico Tie & Timber Company, Alamogordo, N. M., and for a portion of this period was employed by the Colorado Springs & Cripple Creek Short Line, handling steel and surfacing gangs. Mr. LaPeen was foreman of a bridge and building and track gang for the Laramie, Hahn's Peak & Pacific in 1905 and 1906, and in 1907 was a section foreman on the Union Pacific. In 1909 he became a foreman on the Oregon Short Line in the Salt Lake City yards, and in 1912 went with the Southern Pacific as a foreman in the Carlin yards at Carlin, Nev., which position he filled until 1921 except for eight months during 1912 when he served as roadmaster on the Ogden Rapid Transit Street Car Lines at Ogden, Utah.

Carl E. Gosline, treating inspector on the Delaware, Lackawanna & Western, with headquarters at Paterson, N. J., has been promoted to roadmaster with headquarters at Hoboken, N. J., succeeding **W. L. Madill**, resigned. Mr. Gosline was born at Beaver, Pa., on February 14, 1880, and graduated from the Pennsylvania State College in 1906. Beginning in 1902 he was employed at intervals as an assistant in the engineer corps on the Pittsburgh division of the Pittsburgh, Cincinnati, Chicago & St. Louis. In 1906 he was employed by the Buffalo and Susquehanna as a transitman on new construction. In 1907 he returned to the Pittsburgh, Cincinnati, Chicago & St. Louis, remaining there until 1908 when he went to work for the Chicago & Eastern Illinois as an assistant in the engineering corps. From July, 1908 to November, 1909 he served as treating inspector, first on the Chicago & Eastern Illinois and subsequently on the Chicago, Rock Island & Pacific. In November, 1909 he left the Rock Island to become treating inspector for the Delaware, Lackawanna & Western, remaining in this position until his recent promotion to roadmaster as noted above.

A. H. Hobert has been appointed roadmaster on the Iowa and Minnesota division of the Chicago, Milwaukee & St. Paul, with headquarters at Farmington, Minn., succeeding **N. F. Kelsey**, who has been transferred to the Dubuque division, with headquarters at Dubuque, Iowa. Mr. Kelsey succeeded **J. J. Lanin**, who has been assigned to other duties. **E. Cush**, roadmaster on the Illinois division, with headquarters at Savanna, Ill., has been transferred to the Prairie du Chien division, with headquarters at Madison, Wis., succeeding **J. S. LaTronch**, who was temporarily transferred to the Dubuque division, with headquarters at North McGregor, Iowa, and has since been assigned to other duties. **W. J. Whalen**, roadmaster at North McGregor, Iowa, was temporarily transferred to the Illinois division, with headquarters at Savanna, Ill., but has been returned to the Dubuque division. **R. J. O'Connor**, roadmaster on the Mineral Point division, with headquarters at Janesville, Wis., who was temporarily transferred to the Milwaukee Terminals, succeeding **J. Glynn**, assigned to other duties, has since been transferred to the Illinois division, with headquarters at Savanna, Ill., following Mr. Whalen's return to North McGregor. **A. J. Barbee**, roadmaster of the Sioux City and Dakota division, with headquarters at Yankton, S. D., has been appointed

assistant roadmaster at Milwaukee Terminals to take the place of Mr. O'Connor. **T. C. Barrett** has been appointed roadmaster on the Mineral Point division, with headquarters at Janesville, Wis., succeeding Mr. O'Connor. **C. A. Montgomery** has been appointed roadmaster of the Iowa and Dakota division, with headquarters at Sanborn, Iowa, succeeding **O. H. Olson**, resigned. **C. E. Kemp**, roadmaster, with headquarters at Sioux Falls, S. D., has been transferred to the Sioux City and Dakota division, with headquarters at Yankton, S. D., in place of Mr. Barbee and **J. M. Murphy** has been appointed roadmaster, with headquarters at Sioux Falls, S. D., succeeding Mr. Kemp. **T. A. Ealy**, roadmaster, with headquarters at Scotland, S. D., has had his headquarters changed to Yankton, S. D. **William Ronallo** has been appointed roadmaster of the Chicago Terminals, with headquarters at Chicago, succeeding **H. C. Schneider**, resigned.

J. J. Desmond, roadmaster of the Louisiana division of the Illinois Central, with headquarters at McComb, Miss., has been transferred to the Chicago Terminal, with headquarters at Chicago, succeeding **P. H. Leonard**, who has been appointed track supervisor with the same headquarters. **C. M. Chumley**, roadmaster of the Mississippi division, with headquarters at Water Valley, Miss., has been transferred to the Louisiana division, succeeding Mr. Desmond. **C. M. Pittman, Jr.**, succeeds Mr. Chumley.

BRIDGE

T. A. Reagan has been appointed master carpenter on the Baltimore & Ohio, with headquarters at Newark, Ohio, succeeding **E. C. Zinsmeister** on leave on absence.

P. G. Lang, Jr., assistant engineer of bridges of the Baltimore & Ohio, with headquarters at Baltimore, Md., has been promoted to engineer of bridges, succeeding **W. S. Bouton**, assigned to other duties.

W. J. Coughlin, bridge and building master of the Superior division of the Canadian National, with headquarters at Hornepayne, Ont., has been appointed assistant to bridge and building master, with headquarters at Capreol, Ont.

J. A. Campbell, who has been on temporary leave of absence, has resumed service as supervisor of bridges and buildings of the Tacoma Division of the Northern Pacific, with headquarters at Tacoma, Wash., in place of **Samuel Michaels**.

R. Pierce, maintenance of way inspector on the Erie, with headquarters at Hornell, N. Y., has been appointed master carpenter on the Susquehanna Division, with headquarters at Elmira, N. Y., relieving **M. G. Tribe**, who has been transferred to Salamanca, N. Y., in place of **W. H. Matthews** who has been appointed inspector of bridges.

E. M. Anderson, whose promotion to master carpenter on the Chicago, Burlington & Quincy, with headquarters at Wymore, Neb., was announced in last month's issue, was born at Reftele, Sweden, on October 9, 1883, and entered railway service with the Chicago, Burlington & Quincy as a bridge laborer in January, 1903. In September, 1906, Mr. Anderson was promoted to bridge foreman, which position he held at the time of his recent promotion.

H. M. Farmer, bridge and building master on the Farnham division of the Quebec district of the Canadian Pacific, with headquarters at Farnham, Que., has been transferred to the Laurentian division, with headquarters at Ste. Therese, Que., succeeding **E. Paquette**, retired. **I. Verschelden**, bridge and building master of Montreal terminals, has been transferred to the Farnham division, in place of Mr. Farmer. **W. F. Koehn**, assistant bridge and building master, with headquarters at Montreal, has been promoted to bridge and building master with the same headquarters, succeeding Mr. Verschelden.

OBITUARY

Alexander MacKenzie, roadmaster on the Ontario district of the Canadian Pacific, with headquarters at Lindsay, Ont., died suddenly during the latter part of April while riding on a street car.

C. W. Pifer, office engineer, Department of Way and Structures, United States Railroad Administration, with

headquarters at Chicago, died at his home on April 21. Mr. Pifer was born at LaFayette, Ind., on October 21, 1868, and graduated from Purdue University in 1889. He entered railway service in 1892 with the Pennsylvania. In 1896 he became engineer in charge of special inspections for the Cleveland, Cincinnati, Chicago & St. Louis, and three years later became assistant engineer of the Illinois Central. In 1914 he was appointed senior civil engineer, Interstate Commerce Commission, and in April, 1920, was appointed to the position he held at the time of his death.

William Henry Davisson, assistant district engineer, Bureau of Valuation, Interstate Commerce Commission, with office at San Francisco, died at his home in Oakland, Cal., on May 3, at the age of 58. He was born in Kalamazoo, Mich., and was educated at Griswold College, Davenport, Iowa. He began his railroad service on the Chicago, Rock Island & Pacific in 1884, as chairman. From 1896 to 1900 he was general roadmaster and in 1906 he was appointed assistant chief engineer. A year later he went to the Chicago, Milwaukee & St. Paul, where he was engaged on the construction of the Puget Sound extension, in Montana. In 1910 he was principal engineer on the construction of that part of the present Union Pacific System which lies between Ayer Junction, Wash., and Spokane. He remained here until the work was completed, and in January, 1914, entered the employ of the Interstate Commerce Commission, in charge of roadway inventories in the Pacific district.

Henry B. Ledyard, chairman of the Board of Directors and former president of the Michigan Central, died at his home in Detroit on May 25. Mr. Ledyard was born at Paris, France, on February 20, 1844, and was educated at the United States Military Academy at West Point, New York. He entered railway service in January, 1870, in the engineering department of the Northern Pacific. In July of the same year he became a clerk in the office of the division superintendent of the Chicago, Burlington & Quincy, and in 1872 was promoted to assistant superintendent on that road. A year later he was promoted to superintendent of the Eastern division. In October, 1874, Mr. Ledyard was appointed assistant general superintendent and chief engineer of the Michigan Central and was promoted to general superintendent in 1876. In 1877 he was appointed general manager. Five years later he was elected president of the Michigan Central and served in that position until January, 1905, when he resigned the presidency to become chairman of the Board of Directors. This latter position he held continuously until the time of his death.

Joseph W. Moore, assistant engineer, valuation department of the Illinois Central and Yazoo & Mississippi Valley, died at the Illinois Central Hospital on April 13, following a protracted illness. Mr. Moore was born at Louisville, Ky., March 20, 1874. He attended the University of Kentucky, where he took a special three-year course in engineering. He first entered railway service in August, 1898, in the engineering department of the Louisville & Nashville, with which road he served as rodman, instrumentman, assistant engineer and assistant roadmaster. In 1907 he served for one year as track engineer of the A. & B. Construction Company on the Atlanta, Birmingham & Atlantic, and from June, 1908 to November, 1909, was roadmaster of the latter road. He was assistant engineer in the valuation department of the Central of Georgia from March to June, 1910, when he went to the Southern Pacific, Texas and Louisiana lines as roadmaster at Morgan City, La. Mr. Moore became roadmaster of the International & Great Northern at Navasota, Texas, in December, 1914, and in September, 1916, he was appointed pilot engineer in the valuation department of the Illinois Central. In August, 1919, he was appointed assistant engineer in the valuation department of the Illinois Central, which position he held at the time of his death. Mr. Moore served through the second training camp at Plattsburg in the summer of 1916, and soon after the entrance of the United States into the war he entered the training camp at Camp Grant and was commissioned captain and assigned to command Company "B," 35th Engineers. He served until August, 1919, and following his discharge from service was commissioned Major in the Engineers Reserve Corps.

CONSTRUCTION NEWS

The Atchison, Topeka & Santa Fe has awarded the contract for a craneway building at Topeka, Kan., to Jerome Moss, Chicago, instead of to Joseph E. Nelson & Son, Chicago, as was announced in the May issue.

The Atchison, Topeka & Santa Fe will shortly accept bids for the construction of the bridge over the Des Moines river near Dumas, Mo., to cost approximately \$356,000. This company has ordered new electrically operated cinder conveyor equipment from the Roberts & Schaefer Company, Chicago, for installation at Albuquerque, N. M. This road is accepting bids for the construction of a second floor extension with dimensions of 24 ft. by 100 ft., to its station and office building at Slaton, Texas.

The Baltimore & Ohio will replace its present double-deck, single-track bridge across the Allegheny river at Foxburg, Pa. The new structure will consist of three double-deck, riveted, single track trusses, each 137 ft. 6 in. long. The contract for the fabrication and erection of this structure has been awarded to the Bethlehem Steel Bridge Corporation.

The Central of Georgia has awarded a contract to the Wright-Nave Company, Asheville, N. C., for the construction of seven miles of branch line and about one mile of mine spurs. The branch line will run in a southeasterly direction from McCombs Station, Ala. The grading will average about 40,000 sq. yds. per mile. There will be no important structures on the new line and coal will be the principal commodity handled.

The Chesapeake & Ohio has entered into an agreement with the county authorities of Logan County, W. Va., for the construction of a bridge across the Guyandot river. The county is to construct the substructure and the company is to build the superstructure and the approaches.

The Chicago & North Western has awarded contracts for the construction of concrete bridges throughout the system to the Widell Company, Mankato, Minn.; S. G. Cool, Manitowoc, Wis.; Peppard & Burrill, Minneapolis, Minn., and White & Duffy, Milwaukee, Wis. The total cost of the work will be approximately \$200,000.

The Chicago & North Western has awarded a contract to Witherspoon & Englar, Chicago, for rebuilding the company's grain elevator on the Calumet river, Chicago, which was destroyed recently by an explosion.

The Chicago, Rock Island & Pacific is accepting bids for the construction of a new roundhouse at Amarillo, Tex.

This company has awarded a contract to Roberts & Schaefer Company, Chicago, for the construction of a coaling station at Morris, Ill. The station will be a 500-ton, fireproof structure.

The Chicago Union Station Company closed bids on May 26 for the completion of the filled portion of the Polk street viaduct, Chicago, and the construction of a viaduct on Van Buren street, between Canal street and the Chicago river.

The Detroit & Ironton has received a certificate from the Interstate Commerce Commission authorizing the construction of a line in Wayne County, Mich., approximately 15 miles long, extending southward from Spring Wells or Fordson to a connection with the Detroit, Toledo & Ironton near Trenton or Flat Rock. The matter of the application for a certificate authorizing the acquisition by lease of the property of the Detroit, Toledo & Ironton has been assigned for argument before the commission in Washington on May 27.

The Grand Trunk is reconstructing its bridge over the Beauharnois canal near Cecile Junction, Que., at an expenditure of approximately \$70,000. The company is also adding a roadway and sidewalk to its international bridge at Black Rock, N. Y., involving the expenditure of \$40,500.

The Illinois Central closed bids on May 23 for the construction of a subway near Earlville, Ia. The company is also

accepting bids for an extension to its roundhouse at Paducah, Ky.

The Illinois Central has awarded a contract to Joseph E. Nelson & Sons for the construction of the substructure of an overcrossing of the Illinois Central over the Chicago, Milwaukee & St. Paul, at Genoa, Ill. The work will consist of the building of two concrete abutments at an estimated cost of \$40,000.

This road has awarded a contract to Joseph E. Nelson & Sons for the remodeling of the engine terminal at Freeport, Ill. The work consists of a 20 ft. extension at the rear of 12 stalls to afford adequate stall length for accommodating Mallet locomotive, the building of three drop pits and the remodeling of the tool house.

This company has awarded a contract to P. A. Shugart and Blythe Brothers, Nevada, Iowa, for grading in connection with the construction of yard facilities at Clinton, Ill. The improvements include the construction of a northbound unit of 14 tracks and a southbound unit of 10 tracks, each of 100 car lengths. The total cost of the work will be \$650,000. A contract has been awarded to the Unity Construction Company, St. Louis, Mo., for the construction of a viaduct over McLemore avenue, Memphis, Tenn. The company has also awarded contracts to the Ellington-Miller Company, Chicago, for the construction of subways at Eighth and Fourteenth streets, Fort Dodge, Iowa. The company is accepting bids for the construction of 6 additional yard tracks at Paducah, Ky., at a cost of \$225,000. Bids will shortly be accepted for the construction of 8,000 feet of storage tracks at Destrehan, La., and for 11,500 feet of storage tracks at Good Hope, La.

The Kentucky & Tennessee received a certificate from the Interstate Commerce Commission, authorizing the construction of a branch line in McCreary County, Kentucky, a distance of 9,230 ft., to reach a tract of coal land.

The Louisiana & Arkansas is preparing plans for the construction of a machine shop and other buildings at Stamps, Ark., and will soon be ready to accept bids on the work.

The Louisville & Nashville has awarded contracts to the Roberts & Schaefer Company, Chicago, for the installation of two electrically operated cinder plant equipments at Hazard and Loyall, Ky.

The Maine Central will build an eight-span steel bridge with concrete piers over the Kennebec river at Norridgewock, Me. T. Stuart and Sons, Newton, Mass., have been awarded the contract for the foundations and the Bethlehem Steel Bridge Company for the steel. The cost of the work is estimated at approximately \$125,000.

The Missouri Pacific has awarded a contract to Joseph E. Nelson & Sons for the construction and equipping of pumping stations at Guion, Ark., Cotter, Comal and Myrtle and Branson, Mo., at an estimated cost of \$80,000.

The New York, New Haven & Hartford has awarded a contract to D. O'Connell's Sons, Holyoke, Mass., for regading a portion of its freight yards and removing and relaying several tracks and cranes at Springfield, Mass., and other work incidental with the construction of the Springfield-West Springfield bridge, now being built under the jurisdiction of Hampden county, Mass.

The Pittsburgh & West Virginia contemplates the construction of a branch line, 3½ miles in length, running north from Virginia Station, W. Va. The grading on this line will be done under contract.

The Southern Pacific, Texas Lines, has awarded contracts to the W. C. Hedrick Company, Dallas, Tex., for the construction of a three-story storehouse, with dimensions of 60 ft. by 208 ft., of reinforced concrete, hollow tile and brick construction, to cost approximately \$100,000, and a coach paint shop of steel construction with dimensions of 173 ft. by 274 ft., to cost approximately \$120,000.

The St. Louis-Southwestern will build a frame passenger and freight station at De Witt, Ark. The dimensions of

this building will be 24 ft. by 198 ft. This structure is being erected by the company forces and will cost approximately \$20,000. It will replace a station destroyed by fire.

The Texas Midland has awarded a contract to Becknall Brothers, Terrel, Tex., for the construction of a line between Greenville and Commerce, Tex., at an estimated cost of \$500,000.

The Texas & Pacific has acquired real estate west of the city of Fort Worth, Tex., which will be the site of future yard and terminal improvements. This company also contemplates the construction of a new passenger station at Cottonport, La. This road which was noted in the May issue as accepting bids for the construction of a bridge over Bayou-Plaquemine, La., has awarded a contract for the structural steel and machinery for this work to the Phoenix Bridge Company.

The Union Pacific has awarded a contract to Joseph E. Nelson & Sons for the construction of a concrete and brick interlocking tower at Council Bluffs, Iowa.

The Union Pacific has awarded the contract for the work of lining its Sherman tunnel near Hermosa, Wyo., with concrete to the Utah Construction Company, Ogden, Utah.

This company has awarded a contract to the Utah Construction Company, Ogden, Utah, for the grading and the construction of bridges along a forty-two mile line from Haig, Neb., west into Wyoming.

The Uintah Railway has received from the Interstate Commerce Commission a certificate authorizing the construction of an extension of 19.4 miles from the present terminus at Watson, Utah.

The Uvalde & Northern contemplates the construction of a new station and warehouse at Camp Wood, Tex., in addition to stations at Laguna and Kelly Field, Tex.

The Uvalde & Northern was recently denied a certificate by the Interstate Commerce Commission authorizing construction work by the company. At a re-hearing the commission has issued a report finding that construction work was begun in good faith prior to the effective date of the law requiring certificates by the commission and that, therefore, no certificate of public convenience and necessity is required.

The Wabash is accepting bids for the construction of a brick or stucco passenger station at Macon, Mo., with dimensions of 122 ft. by 24 ft.

IRON AND STEEL

The Baltimore & Ohio has placed an order with the Bethlehem Steel Bridge Corporation for 850 tons of fabricated steel. This material will be used for a bridge at Foxburg, Pa.

The Canadian National Railways have ordered 50,000 tons of rail from the Algoma Steel Corporation, the order having been placed by the Dominion government.

The Chicago, Rock Island & Pacific has ordered 8,000 tons of tie plates from The Railroad Supply Company, Chicago.

The Japanese Government has ordered through Takata & Co., New York, 6,000 tons of 60 and 75-lb. rails, including accessories.

The Kanawha & Michigan has ordered 1,500 tons of rails from the United States Steel Corporation.

The Maine Central has ordered 400 tons of fabricated steel from the Bethlehem Steel Bridge Corporation, this material to be used for a bridge at Norridgewock, Me.

The Missouri, Kansas & Texas has ordered four through riveted truss spans, requiring a total of 680 tons of steel, from the Lackawanna Bridge Company, Buffalo, N. Y.

The Missouri Pacific is inquiring for 500,000 high carbon steel tie plates.

The St. Louis Southwestern has placed an order with the Virginia Bridge & Iron Company for 270 tons of steel to be used for a bridge over the Trinity river in Texas.

The Sierra Railway of California is inquiring for 35 to 40 Rodger ballast cars of 40 and 50-tons capacity.

SUPPLY TRADE NEWS

GENERAL

The H. K. Ferguson, Cleveland, Ohio, has removed its Chicago office from the Rookery building to 1637 Monadnock Block. O. C. F. Randolph remains in charge of the Chicago territory.

The Railway Equipment and Publication Company, publisher of the Pocket List of Railroad Officials and the official Railway Equipment Register, has removed its offices from 75 Church street to larger quarters at 424 West Thirty-third street, New York.

The Simmons-Boardman Publishing Company, publishers of the Railway Maintenance Engineer and other publications, has removed its Cleveland, Ohio office to 4300 Euclid avenue, and has opened a Philadelphia office at 407 Bulletin Building, Philadelphia.

The Jones & Laughlin Steel Company, of Pittsburgh, Pa., has purchased 15 acres of ground with a 2,700 ft. frontage on Lake Michigan, just east of the Illinois-Indiana state line near Chicago. This company already owns other land in the Calumet district, and it is reported that plans are being made to build a steel plant in that district.

PERSONAL

C. B. Cole, formerly manager of the Chicago territory of the Union Twist Drill Company, has joined the sales staff of the Tool Sales & Engineering Company at Chicago.

John J. Swan, for the past two years with the Prest-O-Lite Company at Indianapolis, Ind., has resigned to become associated with the Engineering Business Exchange, New York.

W. F. Robinson, for many years connected with James B. Sipe & Co., Pittsburgh, Pa., has been appointed manager of the railroad sales department of the Tropical Paint Oil Company, Cleveland, Ohio.

A. H. Weston, formerly sales engineer, Lackawanna Steel Company, is now associated with the American Chain Company, Reading specialties division, with headquarters at 1054 Grand Central Terminal, New York City.

Ralph S. Cooper, vice-president and general sales manager of the Independent Pneumatic Tool Company, Chicago, has been appointed general manager in addition to his other duties. Mr. Cooper has just returned from Europe, where he has been for the past eight months establishing branch offices and agencies for the company.

H. M. Davison, who was from 1903 to 1919 with the Hayward Company, New York, and for the two succeeding years was general sales manager for the Ohio Locomotive Crane Company, Bucyrus, Ohio, has again become associated with the Hayward Company and will hereafter be connected with the management of that company. Among other duties he will have the general management of sales.

E. C. Sattley, associated for 20 years with the Page Steel & Wire Company, at Pittsburgh and Monessen, serving a large part of the time as general manager, has joined R. J. Jones, formerly manager, and Oliver G. Boyd, formerly secretary, of the Tube & Supply Company, in forming a new corporation under the name of the Iron & Steel Products Company, with offices at 230 Fifth avenue, Pittsburgh, Pa. The new organization will continue the business heretofore conducted by the Tube & Supply Company. E. C. Sattley is president, R. J. Jones, vice-president, and Oliver G. Boyd, secretary and treasurer of the new company.

Homer J. Forsythe, manager of the construction division of the engineering department of E. I. DuPont de Nemours & Co., Inc., Wilmington, Del., has been appointed assistant general manager of the Hyatt Roller Bearing Company, Newark, N. J., a subsidiary of the General Motors Corpora-

tion. Mr. Forsythe has a wide experience in machine shop work, having been with the engineering department of the DuPont Company since August, 1906, when he began work at the Wilmington office as estimator. Later he held executive positions at the Brandywine shops, Wilmington, and during the war he was made manager of the combined Wilmington shops which were engaged in the construction of material for the war plants. Since the war, Mr. Forsythe served as manager of the construction division of the engineering department.

OBITUARY

Karl G. Roebing, president of John A. Roebing & Sons Company, died on May 30 at his summer home at Spring Lake, N. J.

Alexis I. du Pont, secretary and director of E. I. du Pont de Nemours & Co., died on May 30, at Wilmington, Del., after an illness of ten days.

Lawrence F. Braine, a director of the Rail Joint Company, New York, died on May 24, at his home in New York City, at the age of 64. In 1896 he went with the Continuous Rail Joint Company of America, Newark, N. J., which company was combined later with the Weber rail joint and the Wolhaupter rail joint to form the present Rail Joint Company. From 1905 to 1916 Mr. Braine served as director and vice-president of the Rail Joint Company and then retired from active service, remaining as director of the same company until his death.

Charles Hosmer Morse, chairman of the board of directors of Fairbanks, Morse & Company, Chicago, died on May, 5 at his home in Winter Park, Fla. Mr. Morse was born in St. Johnsbury, Vt., on September 23, 1833, and received his education at St. Johnsbury Academy. He began his business career in 1850, as a clerk in the office of E. & T. Fairbanks & Co., scale manufacturers. In 1862, he became a member of the firm of Fairbanks, Greenleaf & Co., Chicago, successors to E. & T. Fairbanks & Co., and on January 1, 1872, when the firm of Fairbanks, Morse & Co. was established, he became president of that company. He retired as president on May 19, 1915, to become chairman of the board of directors of the same company, at which time he was succeeded as president by his son, C. H. Morse, Jr.

George Jesse Foran, for many years manager of the condenser department of the Worthington Pump & Machinery Corporation, New York, died on May 12, at his home in New York City. He was born on January 22, 1862, in Boston, Mass., and graduated from the Massachusetts Institute of Technology in May, 1883, in the department of mechanical engineering, with the degree of bachelor of science. The following September he entered the employ of the Deane Steam Pump Company, Holyoke, Mass., and shortly afterwards was transferred to the Boston office of that company. In November, 1886, he went with the George F. Blake Manufacturing Company as a salesman and later served also as consulting engineer to the president and treasurer of the Blake company. From 1890 to 1897, he was office manager of the new Blake works at East Cambridge, Mass., also head of the estimating and cost department, later returning to the engineering sales department. The above companies were consolidated with others in 1901, to form the International Steam Pump Company, and Mr. Foran then went to New York, as manager and chief engineer of the condenser department of Henry R. Worthington and the associated

companies of the International Steam Pump Company. He continued in that position with the Worthington Pump & Machinery Corporation, which succeeded the International Steam Pump Company.

TRADE PUBLICATIONS

Welding Specialties.—The Transportation Engineering Corporation, 200 Fifth avenue, New York, has recently issued a small pamphlet illustrating and describing a number of the electric arc welding accessories manufactured by this company. The specialties described are welding helmets, goggles, a portable sand blast, a metal electrode holder and various types of coated electrodes.

Horizontal Return Tubular Boilers.—The Bigelow Company, New Haven, Conn., has reprinted in a separate book matter relating to their return tubular boilers appearing in the company's regular catalogue. This includes a general description of this type of boiler, detailed instruction for setting, illustrations of boilers and furnaces and comprehensive tables of data.

Automatic Lowering Jacks.—Automatic lowering jacks, as distinguished from trip jacks, is the subject of a 16-page booklet recently prepared by the Duff Manufacturing Co., Pittsburgh, Pa. This booklet is devoted to the illustrating and describing of the company's line in this type of jack, of which there are 10 models, and announces several new features in jack construction and operation.

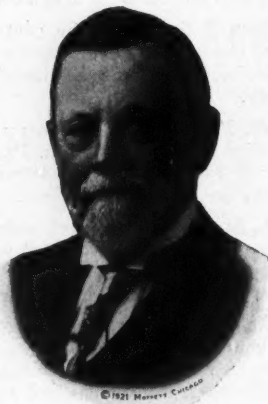
Lime Mortar.—An interesting and instructive booklet of 12 pages has been prepared by the National Lime Association, Washington, D. C., supporting the continued use of lime in all mortars. The booklet, constituting the company's bulletin 300, is devoted to a study of the tests made at Columbia University, New York City, to determine the strength and elastic properties of brick masonry construction when laid up in various mixtures of lime-cement mortar.

Industrial Locomotives.—A 16-page booklet has recently been published by The Burton Engineering & Machinery Company, Cincinnati, Ohio, illustrating and describing the Burton locomotives. These locomotives comprise a system of gasoline or kerosene motive power for narrow gage haulage. The locomotives are built in 3½ and 6 ton weights for 18 in. to 4 ft. 8½ in. track and are described with respect to their use in railroad service, general construction, sand and gravel pits, industrial plants, etc.

Blawforms for General Construction.—The Blaw-Knox Company, Pittsburgh, Pa., has recently issued a large size, 52 page, illustrated pamphlet descriptive of the line of forms manufactured by this company for general concrete construction. Among the numerous kinds of forms illustrated and described are those of various sizes and types for sewer construction, tunnels, subways, heavy walls, piers, fixed and traveling type centers for bridges and others for miscellaneous construction work.

Concrete Hardening and Bonding.—The Livingstone Company, Baltimore, Md., has issued a 12-page folder on its "Livingstone" bonding cement and "Lithotex" concrete hardener. The folder devotes space to the theory and practice of bonding top finishes to concrete bases and contains information relative to its two products together with specifications for its use on new construction and patchwork. This information is supplemented with illustrations of buildings on which it has been applied and also classified lists of users, including railroads.

Pneumatic Collecting and Conveying Systems.—The B. F. Sturtevant Company, Boston, Mass., has issued an engineering bulletin, No. 261, containing information about pneumatic collecting and conveying systems for dust removal and other purposes, as manufactured by this company. The illustrations show the various types of fans made by the concern, a variety of types and plans of dust removal installations, piping, hoods and power arrangements. The text explains in detail the point to be considered in dust collecting as well as including a number of tables on pressures, friction losses, velocities and sizes, capacities and weights of exhausters and piping.



Charles Hosmer Morse

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will save you time, labor, and money on new construction and maintenance of way work. This bender bends all sections of T-rail up to and including 135 lb. rail within 10" of the end without applying splice bars or another section of rail and especially useful for guard rail and switch work. You can bend either right or left by just reversing the hook.

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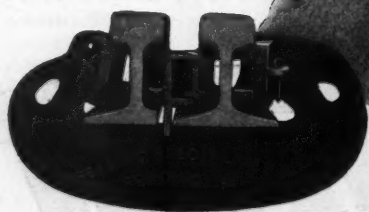
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makes for better and safer transportation. It acts as a shock absorber, eliminates strain on yoke and prevents pulling in of stock rail at this point. The wide end construction of yoke prevents clamp from slipping from its right angle position.



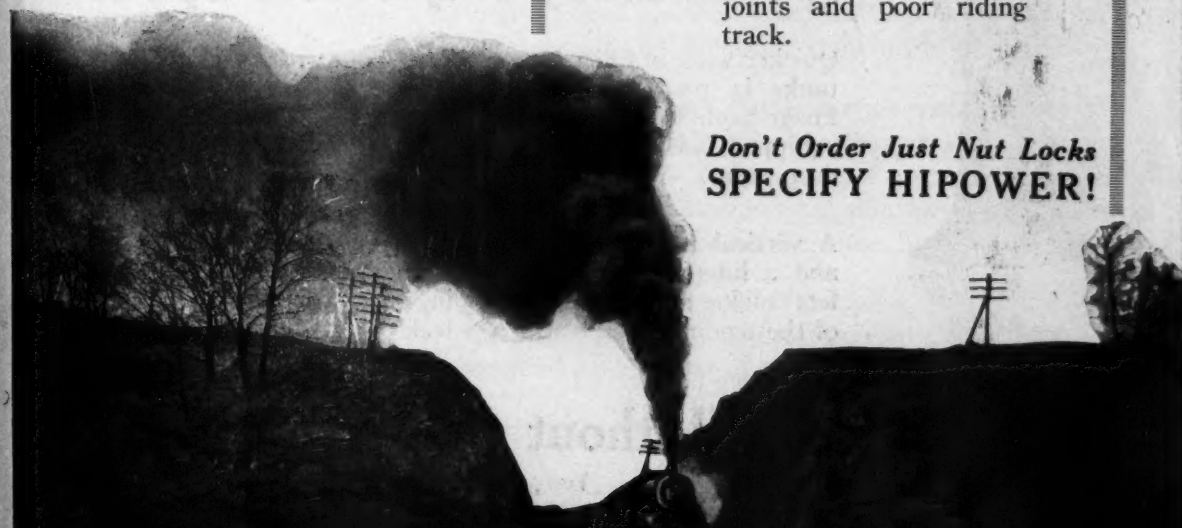
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cushion bolts against impact of the rolling load, and prevent battering of rail ends which produces wide gauge, low joints and poor riding track.

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**POAGE Style H
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An Instantly Adjustable Spout

Quicker work in filling tender tanks is possible with the Poage Style H Water Column equipped with the Fenner drop spout.

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The spout avoids the usual winter troubles in cold climates. It has a non-freezable telescopic joint. This is entirely open. There is no packing of any sort. Yet it does not leak or waste a drop of water.

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Even on high pressure water mains, the Poage Style H Valve is closed quickly without danger to the mains from water hammer. The flow is cut down 85 per cent very rapidly and the remaining 15 per cent more slowly.

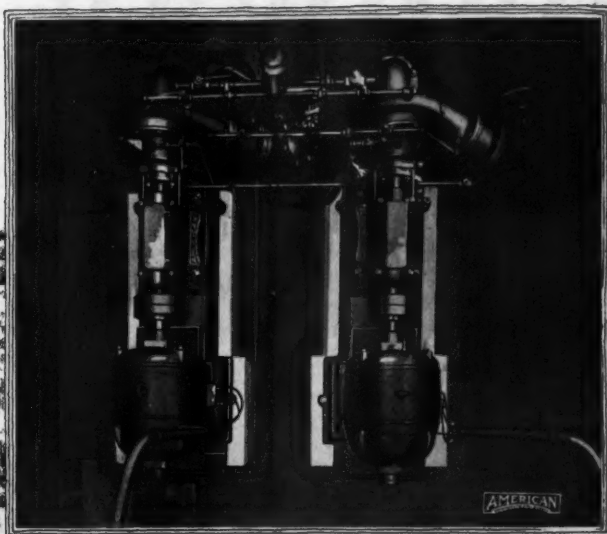
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Roadway and Track

By W. F. Rench
Civil Engineer



THE book is written by W. F. Rench, C. E., formerly a supervisor on the Pennsylvania Railroad, whose experience in maintenance of way work covers a period of twenty-five years as a member of that road's engineering and maintenance of way departments.

THE author not only brings to you a wealth of material accumulated during his years of work and supervision of that busy stretch of track between New York and Washington, but in addition has supplemented his personal experiences by a study of similar problems on many other roads in different sections of the United States.

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These headings serve to show how thoroughly the subjects of railway and track are covered.

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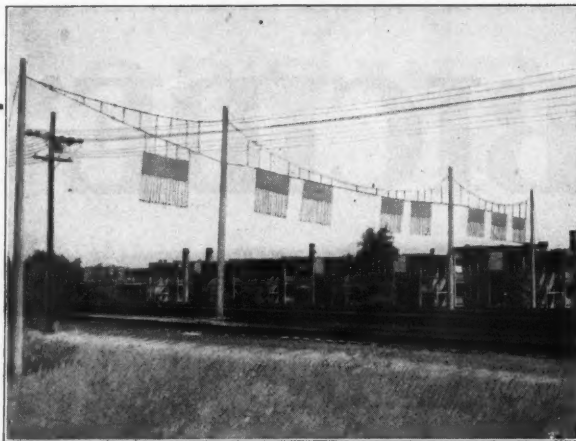
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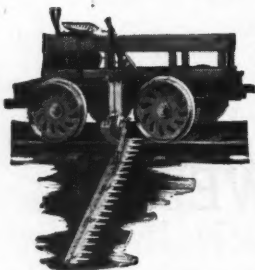
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An attachment for Motor, Hand, or Push car, Operated by Section Men.

Cuts grass and weeds in one-twentieth of the time required by the old-fashioned scythe.

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There are at least three points of importance to be kept in mind in the selection of castings for the operative parts of railway permanent way structures—coaling plants, bridge castings and gears, and the like.

First: The selection of material with reference to the service;

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Observance of these points insures good castings.

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Knows how to make them
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Bethlehem One-Piece Guard Rail

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Atlanta



Sales Offices:

Pittsburgh
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Bethlehem One-Piece Guard Rails in Large Eastern Railroad Terminal

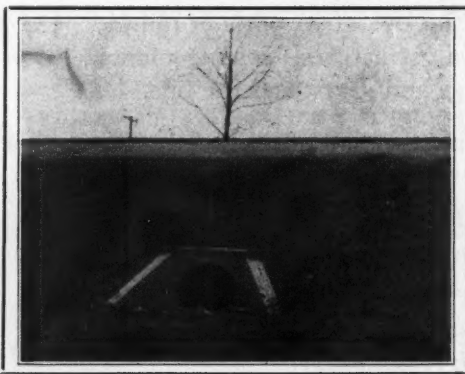
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Aeron System
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GETTING MORE AND BETTER WORK DONE with fewer workmen, or in less time, is accomplished with Aeron spray-painting equipment.

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The Bucyrus Spreader Plow

is heavier, stronger, and more massive in construction than any similar machine ever built (weight 70 tons, 60% steel castings).

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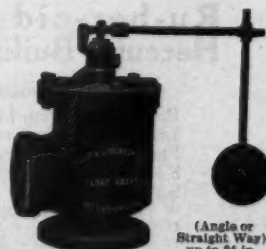
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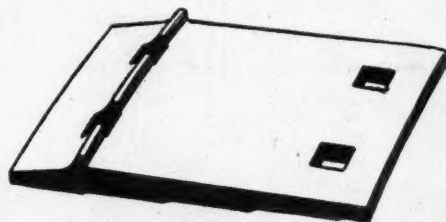
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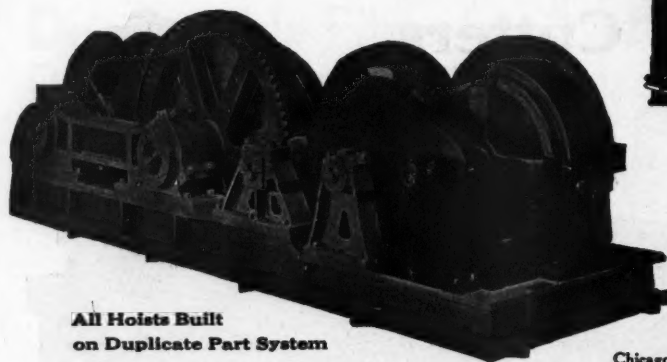
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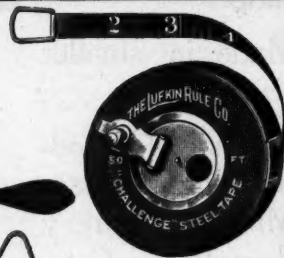
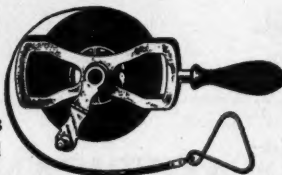
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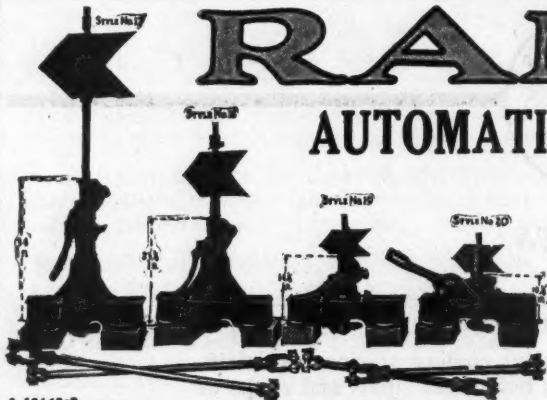
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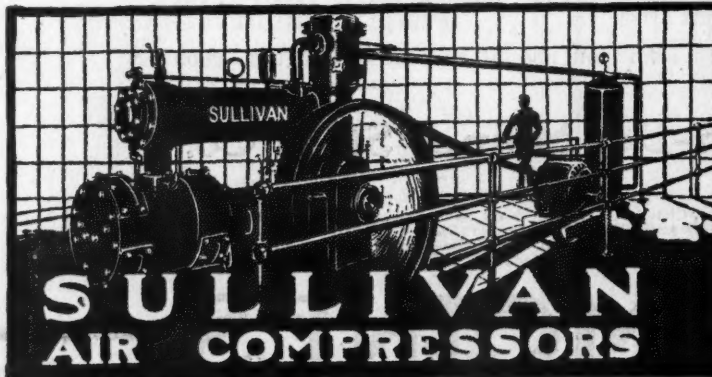
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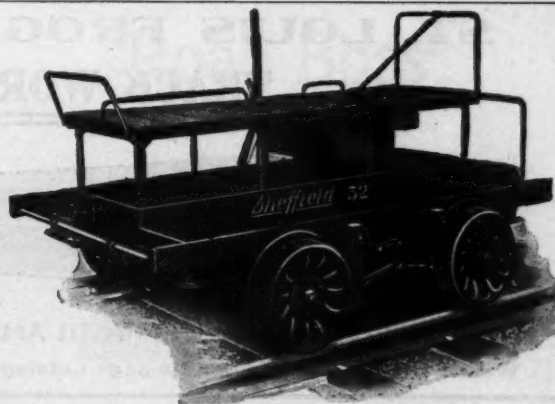
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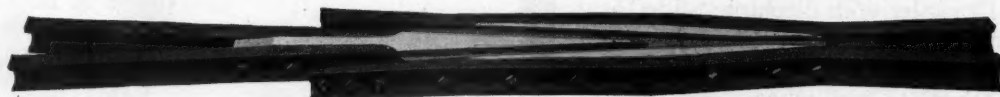
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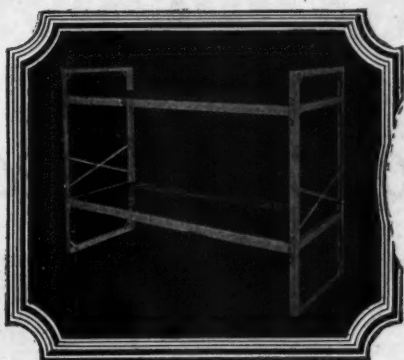


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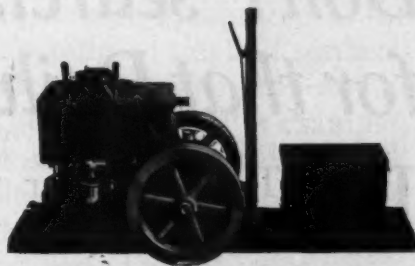
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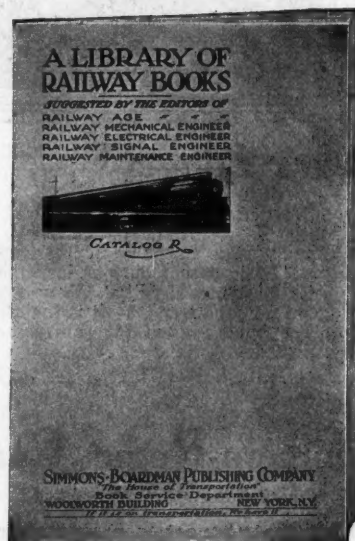
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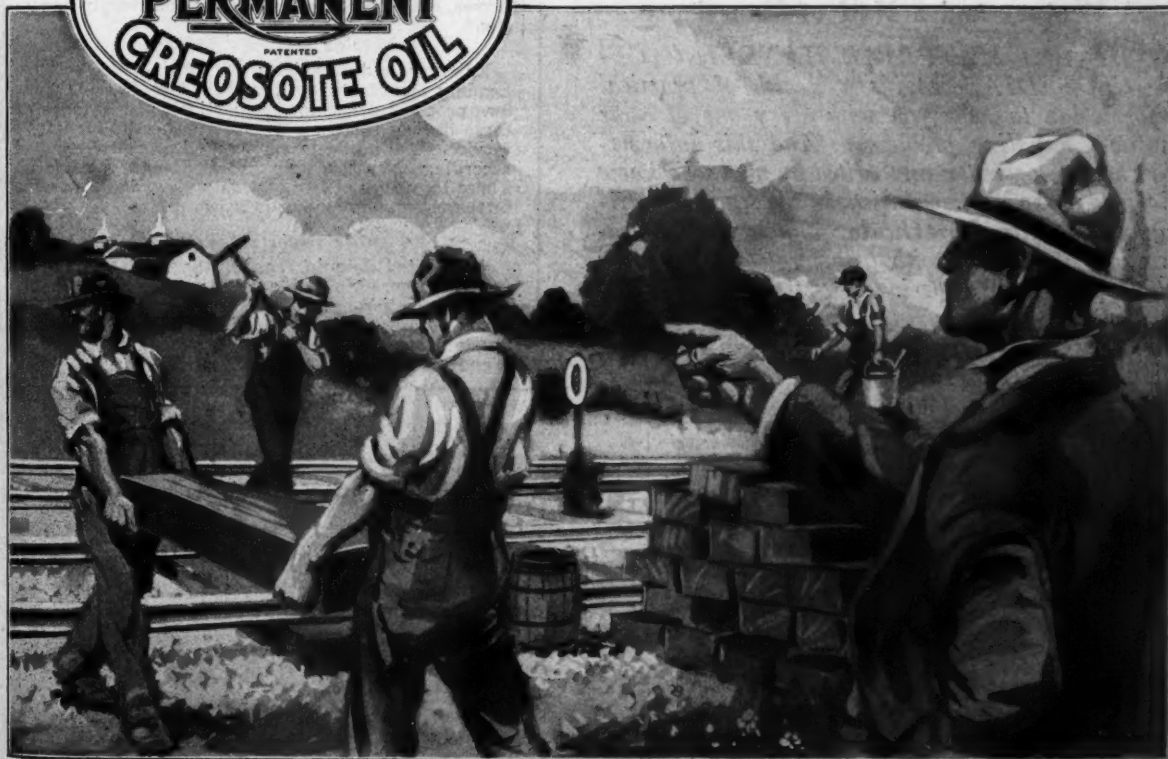
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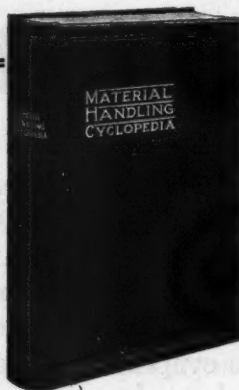
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